सत्यमेव जयते

Manual for Dengue Prevention and Control

2013

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Community Health
Library and Information Centre (CLIC)
Community Health Cell
85/2, 1st Main, Maruthi Nagar, Madiwala,
Bengaluru - 560 068
Tel : (080) 25531518 email : clic@sochara.org
www.sochara.org

Manual for Dengue Prevention and control

Regional Office for Health & FW, Bangalore

Directorate of Health & FW Services, Karnataka

2013

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Health Library and Information
CPHE - SOCHARA
Koramangala
Bangalore - 3
15601
TM-120

Preface

A need has arisen to revisit the current strategies for prevention and control of Dengue in view of the increasing incidence of Dengue in several parts of Karnataka.

This comprehensive document is in response to the growing need of district health authorities, PHC medical officers, corporation / municipal health authorities showing a new approach to fully integrated disease and vector surveillance, vector control, clinical case management etc. The objective of this document is to equip the district health authorities and the medical officers of the primary health centers and community health centers in instituting a comprehensive plan at the local level.

The district health and family welfare officer, district vector borne diseases control officer and the district surveillance officer have to prepare the annual action plan for dengue prevention and control showing the resources available / required, activities to be conducted, funds required and indicators to measure progress. A log-frame for activities is to be drawn up showing the time frame, authorities responsible and physical targets. The medical officers at the community health centers, general hospital and the district hospital should assess the facilities available at their institutions for the management. The PHC medical officer has the responsibility to lead the team of multipurpose workers in ensuring surveillance in all villages, identifying and managing an outbreak, treatment of dengue cases, referral of severe cases, regular source reduction activities etc.

Various inputs are being provided by Directorate of NVBDCP and state health department for prevention and control of Dengue. This manual is aimed at providing technical information in making best use of the inputs and thereby reducing the dengue burden in the community.

This manual is based on the Mid Term Plan developed by Dte of NVBDCP with suitable modifications and additions as per local needs. Other guidelines of Dte of NVBDCP have also been referred to. It also contains useful information on chikungunya.

Dr. B.N. Dhanyakumar
Director of Health Services

Dr. K. Ravi Kumar
Senior Regional Director

Chapter 1

1.1 Dengue Introduction

Dengue is a self limiting acute viral disease characterized by fever, headache, muscle, joint pains, rash, nausea and vomiting. Dengue is caused by an arbovirus and spread by Aedes mosquitoes. Some infections result in dengue haemorrhagic fever (DHF) and in its severe form dengue shock syndrome (DSS) can threaten the patient's life primarily through increased vascular permeability and shock. The epidemiology of dengue is a complex phenomenon that mainly depends upon an intricate relationship between the 3 epidemiological factors: the host (man and mosquito), the agent (virus) and the environment (abiotic and biotic factors). The complexity of relationship among these factors eventually determines the level of endemicity in an area.

1.1. Global scenario of dengue: Like malaria dengue is a disease of tropical and subtropical regions of the world. Across the globe, 2.5 billion people live in those areas at risk for developing dengue. It is estimated that each year about 50 -100 million dengue cases and 0.25 -0.5 million cases of DHF occur.

1.2 Dengue in India: Dengue fever was reported for the first time in India in Vellore district in Tamil Nadu state in the year 1956. Since then most states across the country have reported cases and have become endemic. Out of 35 states/ UTs, 31 have reported Dengue cases during last two decades from 1991to 2012. Table-1 shows the ncidence of Dengue over the years. (http://nvbdcp.gov.in)

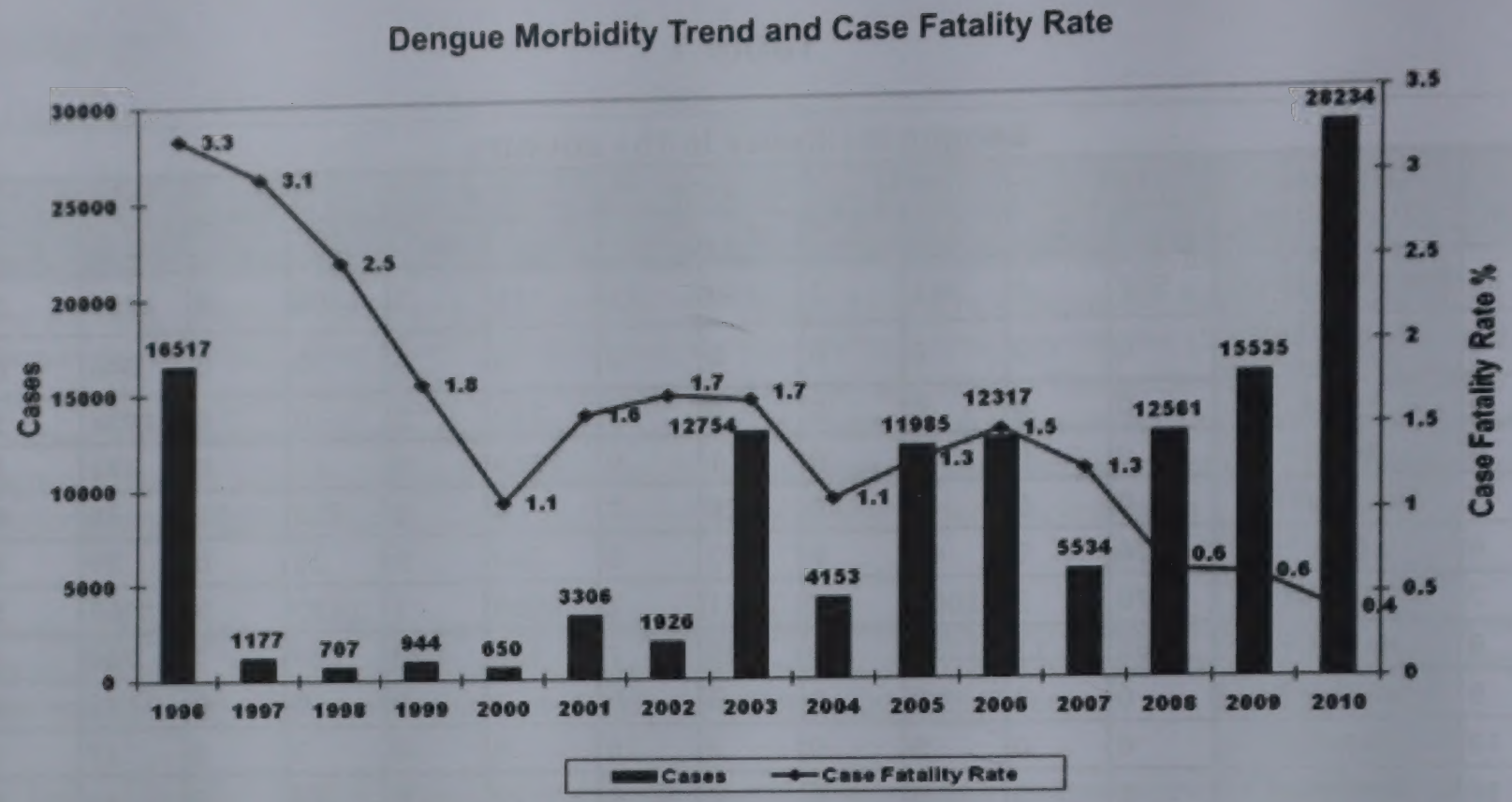
Recurring outbreaks of DF/DHF have been reported from Andhra Pradesh, Delhi, Goa, Haryana, Gujarat, Karnataka, Kerala, Maharashtra, Rajasthan, Uttar Pradesh, Pondicherry, Punjab, Tamil Nadu and West Bengal. During 2012, severe outbreaks of DF/DHF have occurred with 49602 reported case and 241 deaths reported from 31 States and 3 Union territories. The districts / states that reported Dengue cases since 1991 to 2012 are shown in pictorially Fig 1.

(Fig 1)

The case fatality rate (deaths per 100 cases) due to dengue was 3.3 % in 1996. Thereafter though it declined but consistently had been above 1.0% till 2007. After the National Guidelines on clinical management of DF/DHF/DSS was developed and circulated in 2007, the case fatality rate started declining as shown in the Fig 2

Table 1

Dengue incidence in the country												
Sl. No.	Affected States/UTs	2007		2008		2009		2010		2011(P)		2012 (P)	
		C	D	C	D	C	D	C	D	C	D	C	D
1	Andhra Pradesh	587	2	313	2	1190	11	776	3	1209	6	2299	2
2	Arunachal Pradesh	0	0	0	0	0	0	0	0	0	0	346	0
3	Assam	0	0	0	0	0	0	237	2	0	0	1058	5
4	Bihar	0	0	1	0	1	0	510	0	21	0	872	3
5	Chattisgarh	0	0	0	0	26	7	4	0	313	11	45	0
6	Goa	36	0	43	0	277	5	242	0	26	0	39	0
7	Gujarat	570	2	1065	2	2461	2	2568	1	1693	9	3067	5
8	Haryana	365	11	1137	9	125	1	866	20	267	3	768	2
9	Himachal Pd.	0	0	0	0	0	0	3	0	0	0	73	0
10	J & K	0	0	0	0	2	0	0	0	3	0	17	1
11	Jharkhand	0	0	0	0	0	0	27	0	36	0	42	0
12	Karnataka	230	0	339	3	1764	8	2285	7	405	5	3924	21
13	Kerala	603	11	733	3	1425	6	2597	17	1304	10	4172	15
14	Madhya Pd.	51	2	3	0	1467	5	175	1	50	0	239	6
15	Meghalaya	0	0	0	0	0	0	1	0	0	0	11	2
16	Maharashtra	614	21	743	22	2255	20	1489	5	1138	25	2931	59
17	Manipur	51	1	0	0	0	0	7	0	220	0	6	0
18	Mizoram	0	0	0	0	0	0	0	0	0	0	6	0
19	Nagaland	0	0	0	0	25	0	0	0	3	0	0	0
20	Orissa	4	0	0	0	0	0	29	5	1816	33	2255	6
21	Punjab	28	0	4349	21	245	1	4012	15	3921	33	770	9
22	Rajasthan	540	10	682	4	1389	18	1823	9	1072	4	1295	10
23	Sikkim	0	0	0	0	0	0	0	0	2	0	2	0
24	Tamil Nadu	707	2	530	3	1072	7	2051	8	2501	9	12264	66
25	Tripura	0	0	0	0	0	0	0	0	0	0	9	0
26	Uttar Pradesh	132	2	51	2	168	2	960	8	155	5	342	4
27	Uttrakhand	0	0	20	0	0	0	178	0	454	5	110	2
28	West Bengal	95	4	1038	7	399	0	805	1	510	0	6456	11
29	A& N Island	0	0	0	0	0	0	25	0	6	0	24	0
30	Chandigarh	99	0	167	0	25	0	221	0	73	0	351	2
31	Delhi	548	1	1312	2	1153	3	6259	8	1131	8	2093	4
32	D&N Haveli	0	0	0	0	0	0	46	0	68	0	156	1
33	Daman & Diu	0	0	0	0	0	0	0	0	0	0	54	0
34	Puduchery	274	0	35	0	66	0	96	0	463	3	3506	5
	Total	5534	69	12561	80	15535	96	28292	110	18860	169	49602	241

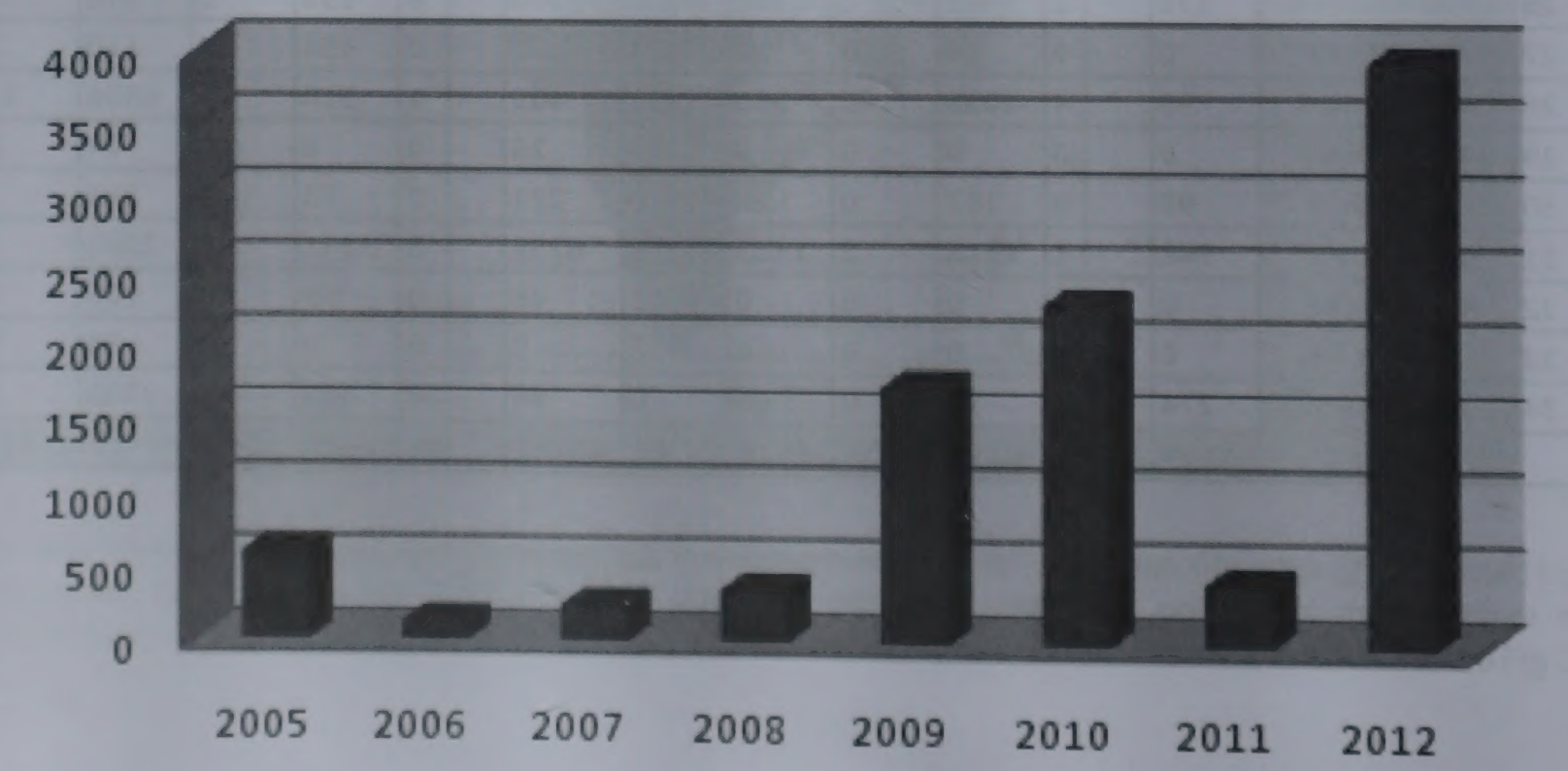


(Fig 2)

Dengue viruses are transmitted from person to person by Aedes mosquitoes of the subgenus stegomyia. Ae. aegypti is the most important epidemic vector, but other species such as Ae. albopictus, Ae. polynesiensis, members of Ae. scutellaris complex, and Ae. (Finlaya) niveus have also been incriminated as secondary vector. However, these species have their own restricted geographical distribution and although they may be excellent hosts for dengue viruses, they are generally less efficient epidemic vector than Ae. aegypti. In recent years occurrence of Ae. albopictus in high density than Ae. aegypti in the dengue affected areas is also suggestive of major role played by Ae. albopictus in dengue transmission.

Dengue incidence in Karnataka:

The incidence of dengue is on an increase over the years in the state except in 2011 when it was less (Fig 3)



(Fig 3)

Twenty one deaths have taken place in the state in the year 2012. Bangalore city and Bangalore (U) have reported 4 deaths each, Raichur 3, Mysore, Belgaum and Kolar 2 each. Shimoga, Chitradurga, Davanagere and Haveri have reported 1 death each.

The number of confirmed cases of dengue in different districts in the year 2012 is shown in table 2.

Table 2

Districtwise incidence of Dengue and Chikungunya								
Sl.No		Dengue				Chikungunya		
		2011		2012		2011		2012
	District	Suspected cases	Confirmed cases	Suspected cases	Confirmed cases	Suspected cases	Confirmed cases	Suspected cases	Confirmed cases
1	Bangalore(U)	30	11	1078	210	16	5	15	4
2	Bangalore (R)	0	0	122	38	32	7	6	3
3	Ramanagar	64	10	183	53	44	4	101	7
4	Kolar	122	15	1464	237	179	25	17	8
5	Chikkaballapur	35	7	151	44	92	19	7	7
6	Tumkur	70	11	244	180	89	25	4	4
7	Chitradurga	83	4	1278	238	5	5	25	6
8	Davangere	141	34	1752	482	64	11	18	1
9	Shimoga	38	6	193	162	20	6		
10	Belgaum	42	4	396	51	224	10	49	3
11	Bijapur	902	7	530	47	271	25	310	55
12	Bagalkote	231	46	307	92	48	10	13	2
13	Dharwad	105	22	244	79	58	11	43	1
14	Gadag	165	7	193	25	29	2	69	8
15	Haveri	22	8	137	104	1	1	1	1
16	U Kannada	41	7	160	67	0	0		
17	Gulbarga	174	0	838	30	320	4	10	5
18	Yadgir	0	0	123	12	0	0		
19	Bidar	55	16	61	17	317	25	58	4
20	Bellary	174	29	753	291	20	15	19	17
21	Raichur	193	32	580	86	0	0	227	9
22	Koppal	86	12	687	68	0	0	142	10
23	Mysore	18	1	17	4	0	0	7	1
24	Chamarajnagar	0	0	7	6	0	0		
25	Mandya	48	3	100	20	49	12	100	9
26	Hassan	29	4	633	20	6	2	29	0
27	D. Kannada	344	8	461	37	2	2		
28	Udupi	23	12	603	120	6	6	34	3
29	Chikmagalur	125	12	207	40	19	3	1	1
30	Kodagu	2	0	27	5	2	0	9	1
	Bangalore City	93	77	1628	1059	28	20	1068	35
	TOTAL	**3455**	**405**	**15157**	**3924**	**1941**	**255**	**2382**	**205**

1.2 Chikungunya

Chikungunya fever is also a viral disease transmitted by Aedes mosquito. Both Ae aegypti and Ae. albopictus are involved in transmission. It is a debilitating, but non-fatal viral illness. Chikungunya usually starts with sudden fever, chills, headache, nausea, vomiting, joint pain, rash and arthalgia. The disease resembles dengue fever and is clinically distinguishable due to arthlgia, otherwise shares the same symptoms, geographical distribution and vectors. The word Chikungunya is derived from east African dialect - Swahili/ Makonde, means that which contorts or bends up. This refers to the contorted (or stooped) posture of patients who are afflicted with the severe joint pain (arthritis) which is the most common feature of the disease. The disease was first described by Marion Robinson and W.H.R. Lumsden, following an outbreak on the Makonde Plateau, along the border between Tanganyika (present Tanzania) and Mozambique in 1952. Since 1953, the virus has caused outbreaks in Africa and South Eastern Asia, including India, Sri Lanka, Myanmar, Thailand, Indonesia, Philippines and Malaysia. A distinctive feature of Chikungunya virus is that it causes explosive outbreaks, before apparently disappearing for a period of several years to decades.

In India a major epidemic of Chikungunya fever was reported during the last millennium viz.; 1963 (Kolkata), 1965 (Pondicherry and Chennai in Tamil Nadu, Rajahmundry, Vishakapatnam and Kakinada in Andhra Pradesh; Sagar in Madhya Pradesh; and Nagpur in Maharashtra) and 1973, (Barsi in Maharashtra). Thereafter, sporadic cases also continued to be recorded especially in Maharasthra state during 1983 and 2000. After quiescence of three decades in 2006, Chikungunya outbreak occurred again in India. Though Andhra Pradesh and Karnataka had reported of clinically suspected Chikungunya cases in November and December 2005, serological confirmation of Chikungunya infection was done in 2006 January onwards. Total 1.39 million clinically suspected cases have been reported by 16 states/UTs out of 35 in the country in the year 2006. All the peninsular states were affected. Maximum cases were reported by Karnataka, followed by Maharashtra. Since then the number of cases reported have come down drastically. Chikungunya cases in the country since 2006 are summarized in Table 3 and the affected areas are shown in Fig 4.

Fig 4

Clinically Supected Chikungunya Fever Cases

Sl. No.	Affected States/UTs	2006	2007	2008	2009	2010	2011(p)	2012(p)
1	Andhra Pradesh	77535	39	5	591	116	99	2827
2	Bihar	0	0	0	0	0	91	34
3	Goa	287	93	52	1839	1429	664	571
4	Gujarat	75419	3223	303	1740	1709	1042	1317
5	Haryana	0	20	35	2	26	215	9
6	Jharkhand	0	0	0	0	0	816	86
7	Karnataka	762026	1705	46510	41230	8740	1941	2382
8	Kerala	70731	24052	24685	13349	1708	183	66
9	Madhya Pd.	60132	0	0	30	113	280	20
10	Meghalaya	0	0	0	0	16	168	0
11	Maharashtra	270116	1762	853	1594	7431	5113	1544
12	Orissa	6461	4065	4676	2306	544	236	129
13	Punjab	0	0	0	0	1	0	1
14	Rajasthan	102	2	3	256	1326	608	172
15	Tamil Nadu	64802	45	46	5063	4319	4194	5018
16	Uttar Pradesh	4	4	11	0	5	3	13
17	Uttarakhand	0	0	0	0	0	18	0
18	West Bengal	21	19138	17898	5270	20503	4482	1381
19	A& N Island	1549	0	0	0	59	96	256
20	Chandigarh	0	0	0	0	0	1	0
21	D&N Haveli	0	0	0	0	0	0	100
22	Delhi	560	203	14	18	120	110	6
23	Lakshadweep	35	5184	0	0	0	0	0
24	Puduchery	542	0	0	0	11	42	45
	Total	1390322	59535	95091	73288	48176	20402	15977

1.3 Existing Strategy for Prevention and Control of Dengue and Chikungunya

Since both Dengue and Chikungunya are spread by the same Aedes vector, the strategy for prevention and control of dengue and Chikungunya are same. As there is no vaccine or specific medicine available against Dengue and Chikungunya infections, vector control is very crucial in controlling or preventing disease transmission. Efforts to reduce mosquito population during the inter-epidemic periods may be highly effective in preventing epidemic transmission. Keeping in view of above, a Long Term Action Plan for Prevention and Control of Chikungunya and dengue is in force in the country since 2007.

The main components of the Long Term Action Plan are as under:

- Surveillance
- Case management
- Integrated vector management
- Supportive intervention:
  - Capacity building
  - Behaviour Change Communication
  - Inter-sectoral Collaboration
  - Operational research
  - Monitoring & evaluation
  - Legislative support

Sentinel Surveillance Hospitals (SSHs) with laboratory have been established in endemic districts for carrying out proactive surveillance during the inter-epidemic period as well as to augment diagnostic facility. All SSHs are linked with Apex Referral Laboratories (ARLs) with advanced diagnostic facilities for back up support. For uniform use of diagnostics, IgM Capture ELISA test (MAC ELISA) has been recommended. National Institute of Virology (NIV), Pune has been entrusted for production and supply of test kits to these laboratories/institutes.

1.4 Factors contributing to spread of Dengue and Chikungunya

Risk of dengue and geographical spread of both Dengue and Chikungunya has shown an increase in the recent years due to various factors in urban, peri-urban and rural areas, leading to proliferation of mosquito breeding sites which are as under:

1. Demographic and societal changes: Demographic and societal changes leading to unplanned and uncontrolled urbanization and concurrent population growth has put severe constraints on civic amenities, particularly water supply and solid waste disposal, thereby increasing the breeding potential of the vector species. To improve the rural health, schemes for safe drinking water are being implemented in many villages across the country. However, the water supply is very erratic, insufficient and inadequate resulting in water storage practices. This leads to increased breeding habitats for Aedes Mosquito.

2. Effective mosquito control is virtually nonexistent in most of the dengue-chikungunya endemic areas. Emphasis has been placed on ultra-low volume insecticide space sprays for adult mosquito control, a relatively ineffective approach for controlling of vectors Ae. aegypti and Ae albopictus.

3. Solid waste management: There has been significant increase non-biodegradable plastics, paper cups, used tyres, etc. that facilitate increased breeding.

4. Booming automobile industry leading to large-scale storage, import, export and dumping of used tyres.

5. Increased population movement (work, travel, tourism or pilgrimage) has resulted in a constant exchange of viruses(dengue serotypes and CHK virus)

6. Significant increase in plantations: Rubber plantation is increasing. This has resulted in increase of breeding avenues for aedes with more and more latex collecting cups. Ae albopictus breeds profusely in the plantation fields of coconut, pineapple banana etc. Transport of tyres also has resulted in passive spread disease since the aedes eggs stick to the invite of tyres.

7. Inadequate infrastructure: Increasing urbanization, budgetary constraints, lack of personnel, the presence of increasing numbers of "closed" households (no one home during the day to allow access to the house or the premise), and householder's rejection for the emptying and cleaning of domestic water-storage containers are important factors.

Chapter 2

Surveillance

2.1 Concept

Surveillance of a disease implies a continuous monitoring of all factors influencing transmission and effective control of that disease. Effective surveillance of DF/DHF infection is essential for monitoring the disease behaviour. For building up capacity for early recognition of impending outbreaks or epidemics it is pertinent that surveillance system collects the information on epidemiologic, clinical, laboratory and entomological parameters from the identified sites on regular basis. This information needs to be statistically valid and be analyzed regularly.

Surveillance requires timely reports from every clinic, private physician and health centre or hospital that provides medical attention to the population at risk. In practice by the time dengue cases are detected and reported by physicians through passive surveillance, substantial transmission has already occurred and may even have peaked. In this case, it is often too late to prevent the epidemic.

The system should be based on standardized case definitions and formalized mandated reporting.

The objectives of surveillance for dengue and chikungunya are to:

- detect epidemics early for timely intervention;
- measure the disease burden;
- monitor trends in the distribution and spread of disease over time;
- assess the social and economic impact of dengue and chikungunya on the affected community;
- evaluate the effectiveness of prevention and control programmes;

Dengue and Chikungunya surveillance has two components:- Epidemiological and Entomological

2.2 Epidemiological surveillance:

Epidemiological surveillance is an ongoing systematic collection, recording, analysis, interpretation and dissemination of data for initiating suitable public health interventions for prevention and control.

In view of the increase in the risk of dengue spread in most parts of the state, it is envisaged to institute sentinel surveillance in every district in an organized manner though the identified laboratory network with the following goals:

- To predict outbreak by developing early warning signals – through proactive surveillance
- To monitor incidence and to prevent outbreaks - through disease surveillance

Epidemiological surveillance is being carried out as following:

- For effective epidemiological surveillance, uniform data collection is initiated in prescribed formats. All suspected cases are recorded.
- All components of surveillance i.e. collection, compilation, analysis and interpretation of data, follow-up action and feedback are carried out in a systematic and organized manner.
- During transmission period (monsoon and post monsoon) reporting is to be on daily basis by email or by fax. In non or low transmission period reporting will be on weekly basis.

- The district NVBDCP Officer and the district surveillance units would arrange epidemiological, entomological, clinical and laboratory investigations, whenever necessary.
- Supervision and monitoring at all levels are to be strengthened for ensuring effective surveillance.

2.2.1 Proactive surveillance

The most important component of this proactive system is serological surveillance designed to monitor dengue virus transmission, especially during inter-epidemic periods and to continually provide information on: where transmission is occurring, what virus serotype or serotypes are involved and what type of illness is associated with the dengue infection. If this type of information is available without delay, one should be able to detect the introduction of virus into a new area/s.

During periods of low dengue virus activities, cases of dengue like illness are frequently not recognized as suspected dengue, because many dengue infections present clinically as non-specific virus illness and physicians may miss them. Therefore, the programme needs to depend upon regular monitoring of the patients with viral syndromes in order to detect dengue viral activity. Blood samples from the suspected patients with viral syndrome have to be collected. Atleast 5-10 samples are to be processed on a weekly basis to detect the presence of dengue specific IgM antibody. The sentinel hospitals will maintain line-listing of dengue positive cases. As soon as a dengue case is confirmed by IgM Capture ELISA Test and/or NS1 Ag test, the District Vector Borne Disease Control Officer/ District Health Officer or Municipal Health Officer is to be intimated so that remedial measures in respect of vector control in the affected area(s) can be initiated immediately. The time lag between intimation received and actions initiated by the district/Municipal authorities should not be more than 24 hrs in order to effectively interrupt transmission.

2.2.2 Disease Surveillance:

The disease surveillance will include clinical surveillance based on clinical case definitions, fever surveillance and sero- surveillance. The clinical spectrum associated with dengue infection ranges from non-specific viral syndrome to severe haemorrhagic disease or fatal shock. It may sometimes be difficult to differentiate the illnesses from those caused by other viruses, bacteria and parasites. Therefore, surveillance should be supported by laboratory diagnosis. The fever surveillance will capture any clustering or increase in fever cases reported by the identified sentinel centre by daily monitoring of the cases. The laboratory will report any sample positive for Dengue. However, the reporting of dengue disease generally has to rely on clinical diagnosis combined with simple clinical laboratory tests and available epidemiological information.

The disease surveillance will include clinical diagnosis, monitoring of fever trends and sero surveillance. The medical OPDs of the hospitals will be the sites for monitoring the clinical cases as per the definitions and fever cases for an increase/ clustering and will send samples of suspected or probable cases for the sero –surveillance.

Case definition of Dengue Fever:

Suspected case:

An acute febrile illness of 2-7 days duration with two or more of the following manifestations:

Headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations.

Confirmed case:

A case compatible with the clinical description that is laboratory confirmed (detection of NS1 Ag and /or presence of IgM Ab).

Case definition of Dengue Haemorrhagic Fever:

a. Suspected or confirmed case of dengue

plus

b. Haemorrhagic tendencies evidenced by one or more of the following
   1. Positive tourniquet test
   2. Petechiae, ecchymoses or purpura
   3. Bleeding from mucosa, gastrointestinal tract, injection sites or other sites
   4. Haematemesis or malena

plus

c. Thrombocytopenia (<100,000 cells per cumm)

plus

d. Evidence of plasma leakage due to increased vascular permeability, manifested by one or more of the following:

   1. A rise in average haematocrit for age and sex > 20%
   2. A more than 20% drop in haematocrit following volume replacement treatment compared to baseline
   3. Signs of plasma leakage (pleural effusion, ascitis, hypoproteinaemia)

Case definition of Dengue Shock Syndrome:

All the above criteria for DHF plus evidence of circulatory failure manifested by rapid and weak pulse and narrow pulse pressure (<20 mm Hg) or hypotension for age, cold and clammy skin and restlessness.

2.3 Networking of Sentinel Surveillance Hospitals, Sentinel Surveillance Laboratories and Apex Referral Laboratories

Sentinel Surveillance Hospitals (SSH) are those which have the facility for management of dengue. All district hospitals function as SSH. Community Health Centers, General Hospitals at taluka level are currently being identified as SSH by training the physicians and paediatricians in management of dengue and by ensuring availability of drugs and necessary laboratory facilities. The SSH mainly undertakes clinical management to the referred cases of DHF and in addition chikungunya, severe malaria and JE. They help in capacity building of PHC /CHC staff and outbreak investigation. They are to have a proactive surveillance system that will permit prediction of dengue outbreak by regular monitoring of the patients with viral syndromes in order to detect dengue viral activity. They participate in serological/virological surveillance designed to monitor dengue virus transmission, especially during inter-epidemic periods and to continually provide information on; where transmission is occurring, what virus serotype or serotypes are involved and what type of illness is associated with the dengue infection. They are expected to ensure that blood samples are collected and processed. They are to maintain line-listing of dengue positive cases and communicate the details to DMO /DSO /Municipal Health Officer by telephone, e-mail or speed post. There is need for strong collaboration with district health authorities.

District laboratories attached to district hospitals and associated with district surveillance units have been identified as Sentinel Surveillance Laboratories (SSL) for carrying out proactive surveillance during the inter-epidemic period and also to augment diagnostic facility. In addition laboratories attached to many major hospitals and medical colleges are also identified as SSL. There are 22 Sentinel Surveillance Laboratories (List enclosed). All these are linked with the Apex Referral Laboratory with advanced diagnostic facilities and backup support.

National Institute of Virology (NIV), Pune has been entrusted for supply of IgM Capture ELISA test kits to the identified institutes as per technical requirements. NIV would also make ELISA based NS1 test kits for supply to the identified laboratories.

Recurring grant is also being provided to the identified laboratories every year to meet the contingency expenditure. To make the Sentinel Surveillance Hospitals functional budget is being provided to meet the contingency expenditure.

Apex Referral Laboratories (ARL) are carrying out effective surveillance of different strains of dengue virus prevalent in the areas of jurisdiction. Similar activity is also being carried out in Manipal Institute of Virus Research Microbiologist and Technicians from the Sentinel Surveillance Hospitals have been trained in the Apex Referral Laboratories on sero-diagnosis. In Karnataka state, Department of neurovirology NIMHANS Bangalore and NIV field station Bangalore function as ARLs. NIMHANS mainly undertakes quality assurance of ELISA tests being done at SSLs by cross-checking selected samples every quarter of the year.

2.3.1 Networking with private hospitals and private laboratories:

Many private hospitals treat dengue cases. Private laboratories conduct dengue diagnostic tests. ELISA based tests are conducted with commercial kits. Rapid tests are also performed. It is imperative that regular reports are obtained from the private facilities regarding the number of suspected and confirmed cases diagnosed and treated. A line-list of of dengue cases is also to be obtained for epidemiological investigation and follow up action.

In this regard circular instructions,in the form of a notification, have been issued by Commissioner, Health and Family Welfare Department vide letter no. DD/SSU/25/2010-11 dated 9 August 2010. In this notification guidelines have been issued for determination of confirmed Dengue /DHF/DSS cases in Private/Public Hospitals – streamlining of reporting and management of Dengue/DHF/DSS cases including deaths due to the said disease. All the private and government health institutions in the state should notify the Dengue / DHF/ DSS cases and deaths hereafter without fail. The report should be sent electronically in the prescribed format shown below to BBMP Chief Health Officer for Bangalore City and District Surveillance Officers for the respective districts, who in turn will share it with State Surveillance Unit (IDSP) on weekly basis during off-season and daily basis during the transmission season (May to October) based on standard WHO / GoI case definitions. It has been specified that the confirmatory test for DHF/DSS is IgM Capture ELISA or confirmed sero-conversion using paired serum samples (first test negative and second test positive). Rapid tests are not reliable in view of variable sensitivity and specificity. Rapid test positive cases can be considered at best as probable cases. 5 % of positives and negatives for dengue cases tested by means of IgM capture ELISA at private institutions should be sent to referral laboratories viz., NIMHANS, Bangalore or NIV field station at Victoria Hospital or PHI with the case sheet details for cross checking. In case of DHF /DSS, the private institutions shall send blood samples in all cases to the Referral Laboratories or Sentinel Surveillance Laboratories for confirmation of serious dengue cases i.e.DHF&DSS. Private hospitals shall confirm a case of death as due to DHF/DSS only after any of the laboratories viz., Referral Laboratories or the Sentinel Surveillance Laboratories confirm the blood sample of the concerned case.

It has also been specified that management of DHF/DSS is based on clinical diagnosis. The confirmatory serological tests of IgM capture ELISA will not come in the way of individual case management. Clinical diagnosis and bed side tests such as the platelet count, haematocrit etc. are important for prognosis and treatment. Indication for giving platelet transfusion is clearly mentioned in the "Guidelines for treatment of Dengue/DHF/DSS" published by WHO / GoI. The Hospitals, Nursing Homes and other such institutions investigating, treating and managing the Dengue/DHF/DSS cases should follow the above guidelines. Reporting should be done as per following format:

Table 4

Daily/ weekly reporting format for dengue /dengue Haemorrhagic fever (DHF)/ Dengue Shock Syndrome (DSS)

Name of the Hospital :

Address / Contact Details :

Date / Week of Reporting :

Sl No	Details	No of cases
1	No of Probable cases of Dengue	
2	No of Confirmed cases of Dengue	
3	No of Probable cases of Dengue Haemorrhagic Fever @/ Dengue Shock Syndrome	
4	No of Confirmed cases of Dengue Haemorrhagic Fever/Dengue Shock Syndrome	
5	No of probable deaths due to Dengue Haemorrhagic Fever /Dengue Shock Syndrome	
6	No of confirmed deaths due to Dengue Haemorrhagic Fever/Dengue Shock Syndrome	

2.4 Fever alert surveillance:

For early detection of any upsurge in fever cases in endemic districts, it is envisaged that the health workers and grassroots level functionaries such as ASHA, AWW and FTD holders shall be trained in identification and reporting of fever cases to district Vector Borne Disease Control Officer directly under intimation to respective PHCs/CHCs. It is also proposed to introduce community monitoring through ASHA in selected high endemic districts to get early information on any upsurge in fever cases, (at any point of time more than ten cases (clustering) in a week in about 500 – 1000 population of the village). This mechanism would facilitate immediate investigation of cause of the fever followed by remedial measures.

2.5 Entomological Surveillance

Basic characteristics of the vectors:

Aedes aegypti is the main vector of transmission of Dengue and Chikungunya in India. However, Aedes albopictus has also been found to be playing a part in some areas. These mosquitoes were originally tree-hole breeders. But due to massive deforestation, they have got adopted to breeding in stored water containers. This species of mosquitoes have short flight range and hence have adapted to indoor biting and indoor and peri-domestic breeding habits which make the control operations by the public health interventions more difficult unless there is community participation. They are principally day biters. Eggs of these vectors have the ability to withstand desiccation for more than a year. The virus of chikungunya and dengue appear to be having a cyclo-propagative mode of transmission and thus trans-ovarian transmission is possible but it is not proved. This could result in the virus remaning in nature for long periods and cause outbreaks.

Aedes aegypti

The mosquito can be recognized by white markings on legs and a marking of the form of a lyre on the thorax. The mosquito originated from Africa but is now found in the tropics worldwide.

Although it may feed at any time, the mosquito bites humans only between a few hours after dawn until an hour or so after sunset.

The mosquito's preferred breeding areas are in areas of stagnant water, such as flower vases, uncovered barrels, buckets, and discarded tires, but the most dangerous areas are wet shower floors and toilet tanks, as they allow the mosquitos to breed right in the residence. Research has shown that certain chemicals emanating from bacteria in water containers stimulate the female mosquitoes to lay their eggs. They are particularly motivated to lay eggs in water containers that have just the right amounts of specific fatty acids associated with bacteria involved in the degradation of leaves and other organic matter in water. The chemicals associated with the microbial stew are far more stimulating to discerning female mosquitoes than plain water, for example, or filtered water in which the bacteria once lived.

Aedes albopictus:

Aedes albopictus, from the mosquito family Culicidae, is characterized by its black and white striped legs, and small black and white body. It is native to the tropical and subtropical areas of Southeast Asia; however, in the past couple of decades this species has invaded many countries throughout the world through the transport of goods and increasing international travel. This mosquito has become a significant pest in many communities because it closely associates with humans (rather than living in wetlands), and typically flies and feeds in the daytime in addition to at dusk and dawn.

This mosquito is about 2 to 10 mm length with a striking white and black pattern. The males are roughly 20% smaller than the females, but they are morphologically very similar. However, as in all mosquito species, the antennae of the males in comparison to the females are noticeably bushier and contain auditory receptors to detect the characteristic whine of the female. The maxillary palpi of the males are also longer than their proboscises whereas the females' maxillary palpi are much shorter. (This is typical for representatives of subfamilies.) In addition, the tarsus of the hind legs of the males is more silvery. Tarsomere IV is roughly three-quarters silver in the males where as the females' is only about 60% silver.The other characteristics do not differentiate between genders. A single silvery-white line of tight scales begins between the eyes and continues down the dorsal side of the thorax. This characteristic marking is the easiest and surest way to identify the Asian tiger mosquito. The probosis is dark colored, the upper surface of the end segment of the palps is covered in silvery scales, and the labium does not feature a light line on its underside. The compound eyes are distinctly separated from one another. The scutum, the dorsal portion of an insect's thoracic segment, is black alongside the characteristic white midline. On the side of the thorax, the scutellum, and the abdomen there are numerous spots covered in white-silvery scales. Such white-silvery scales can also be found on the tarsus, particularly on the hind legs that are commonly suspended in the air. The base of tarsomere I through IV has a ring of white scales, creating the appearance of white and black rings. On the fore legs and middle legs, only the first three tarsomeres have the ring of white scales whereas tarsomere V on the hind legs is completely white. The femur of each leg is also black with white scales on the end of the “knee”. The femurs of the middle legs do not feature a silver line on the base of the upper side, where as, the femurs on the hind legs have short white lines on base of the upper side. The tibias are black on the base and have no white scales.The terga on segments II through VI of the abdomen are dark and have an almost triangular silvery-white marking on the base that is not aligned with the silvery bands of scales on the ventral side of the abdomen. The triangular marking and the silvery band are only aligned on abdominal segment VII. The transparent wings have white spots on the base of the Costas. With older mosquito specimens, the scales could be partially worn off making the previously mentioned characteristics not stand out as much. As with other members of the mosquito family, the female is equipped with an elongated proboscis that she uses to collect blood to feed her eggs. The Asian tiger mosquito has a rapid bite that allows it to escape most attempts by people to swat it. By contrast the male member of the species primarily feeds on nectar.

The female lays her eggs near water; not directly into it as other mosquitoes do, but typically near a stagnant pool. However, any open container containing water will suffice for larvae development, even with less than an ounce of water in. It can also breed in running water, so stagnant pools of water are not its only breeding sites. It has a short flight range (less than 200 m), so breeding sites are likely to be close to where this mosquito is found.

Important morphological differences between Ae. aegypti and Ae. albopictus :

Table 5

Characters	Ae. aegypti	Ae. albopictus
White band on dorsum of the meso thorax (midline)	Absent	Present
Scutulum	Sickle shaped band on either side od scutulum seen	No white band or spots
Abdomen	No bands on the ventral surface	White bands on the ventral surface

Types of information that are needed to estimate the risk of an epidemic are the following:

a) Mosquito population indices (Are vector species present?)
b) Virus infection rates in mosquitoes (What is the minimum infection rate (MIR) this year? How does it compare with MIRs in epidemic years? Is virus activity localized or is it widespread?)
c) Rainfall and temperature data (Is there any evidence to show an association between past outbreaks/epidemics and specific weather patterns?)
d) Time of year (Is it relatively early in the virus transmission season for this locality?)
e) Risk to the human population (Is virus activity near populated areas? Is vector movement between areas of virus activity and populated areas?)

Surveillance for the dengue vector Aedes aegyptis important in determining the distribution, population density, major larval habitats, spatial and temporal risk factors related to dengue transmission and levels of insecticide susceptibility or resistance, in order to prioritize areas and seasons for vector control. These data will enable the selection and use of the most appropriate vector control tools, and can be used to monitor their effectiveness. There are several methods available for the detection and monitoring of larval and adult populations. The selection of appropriate sampling methods depends on surveillance objectives, levels of infestation, and availability of resources. Vector surveillance includes adult and larval as mentioned below:

2.5.1 Adult Surveillance

Adult vector sampling procedures can provide valuable data for specific studies, such as seasonal population trends, transmission dynamics, transmission risk, and evaluation of adulticiding interventions. However, results may be less reproducible than those obtained from sampling of immature stages. The collection methods also tend to be labour intensive and heavily dependent on the collector's proficiency and skill. The available methods are as follows:

2.5.1.1 Oviposition traps

Ovitraps: are devices used to detect the presence of Ae. Aegypti and Ae. Albopictus where the population density is low and larval surveys are largely unproductive (e. g. when the Breteau index is less than 5), as well as under

normal conditions. They are particularly useful for the early detection of new infestations in areas from which the mosquitoes have been previously eliminated. For this reason, they are used for surveillance at international ports of entry, particularly airports, which comply with international sanitary regulations and which should be maintained free of vector breeding. An ovitrap enhanced with hay infusion has been shown to be a very reproducible and efficient method for Ae. Aegypti surveillance in urban are is and has also been shown to be useful to evaluate control programmes, such as the impact of adulticidal space spraying on adult female populations.

2.5.1.2 Tyre section larvitraps

Tyre section larvitraps of various designs have also been used for monitoring oviposition activity, the simplest being a water-filled radial section of an automobile tyre. A prerequisite for any design is that it either facilitates visual inspection of the water in situ or allows the ready transfer of the contents to another container for examination. Tyre larvitraps differ from ovitraps in that water level fluctuations brought about by rainfall induce hatching of eggs, hence the presence of larvae is noted rather than the paddles on which eggs have been deposited.

2.6 Larval Surveillance

For practical reasons, the most common survey methodologies employ larval sampling procedures rather than egg or adult collections. The basic sampling unit is the house or premise, which is systematically searched for water-holding containers.

The commonly used larval indices (house, container and Breteau) are useful for determining general distribution, seasonal changes and principal larval habitats, as well as for evaluation of environmental sanitation programmes. However, they generally have no relevance to the dynamics of disease transmission. The precise levels of vector infestation that constitute a "risk" level for dengue transmission are influenced by many factors, including mosquito longevity and immunological status of the human population. There are examples (e.g. Singapore) where dengue transmission occurred even when the House Index was less than 2%. Therefore, the limitations of these indices must be recognized and studied more carefully to determine how they correlate with adult, female population densities, and how all indices correlate with the disease-transmission risk.

2.6.1 Indices used to assess the levels of Ae. Aegypti infestations

House Index (HI): percentage of houses infested with larvae and/or pupae.

$$HI = \frac{\text{Number of houses infested}}{\text{Number of houses inspected}} \times 100$$

Container Index (CI): percentage of water-holding containers infested with larvae or pupae.

$$CI = \frac{\text{Number of positive containers}}{\text{Number of containers inspected}} \times 100$$

Breteau Index (BI): number of positive containers per 100 houses inspected.

$$BI = \frac{\text{Number of positive containers}}{\text{Number of houses inspected}} \times 100$$

Pupal Index (PI): Number of pupae per house

$$PI = \frac{\text{Number of Pupae}}{\text{Number of houses inspected}} \times 100$$

Containers are examined for the presences of mosquito larvae and pupae. The collection of specimens for laboratory examination is necessary to confirm the species present.

The house index has been most widely used for monitoring infestation levels, but it neither takes into account the number of positive containers nor the productivity of those containers. Similarly, the container index only provides information on the proportion of water-holding containers that are positive. The Breteau index establishes a relationship between positive containers and houses, and is considered to be the most informative, but again there is no reflection of container productivity. Nevertheless, in the course of gathering basic information for calculating the Breteau index, it is possible and desirable to obtain a profile of the larval habitat characteristics by simultaneously recording the relative abundance of the various container types, either as potential or actual sites of mosquito production (e. g. number of positive drums per 100 houses, number of positive tyres per 100 housed, etc.). These data are particularly relevant for focusing control efforts on the management or elimination of the most common habitats and for the orientation of educational messages for community based initiatives.

Determination of container types that play key roles as producers of pupae, and a subsequent focus on these containers for surveillance and/or control is very important.

2.6.2 Sampling strategies

The sample size for routine larval surveys should be calculated using statistical methods based on the expected level of infestation and the desired level of confidence in the results.

2.6.3 Frequency of sampling

Control programmes using integrated strategies do not require sampling at frequent intervals to assess the impact of the applied control measures. This is especially true where the effect of the alternative strategies outlasts residual insecticides (for example, larvivorous fish in large potable water storage containers, source reduction or mosquito-proofing of containers) or when larval indices are high (HI greater than 10%). On the other hand, feedback on at least a monthly basis may be desirable to monitor and guide community activities and to identify the issues that need more scrutiny, especially when the HI is 10% or lower. For specific research studies, it may be necessary to sample on a weekly, daily or even hourly basis (e. g. to determine the diurnal pattern of biting activity).

2.7 Additional information for entomological surveillance

In addition to the evaluation of aspects directly pertaining to vector density and distribution, community-oriented, integrated pest management strategies require that other parameters be measured or periodically monitored. These include the distribution and density of the human population, settlement characteristics, and conditions of land tenure, housing styles and education. The monitoring of these parameters is relevant and of importance to planning purposes and for assessing the dengue risk. The knowledge of changes over time in the distribution of water supply services, their quality and reliability, as well as in domestic water storage and solid waste disposal practices is also particularly relevant. Meteorological data are also important. Such information aids in planning targeted source reduction and management activities, as well as in organizing epidemic intervention measures.

Some of these data sets are generated by the health sector, but other source of data may be necessary. In most cases, annual or even less frequent updates will suffice for programme management purposes. In the case of meteorological data, especially rainfall patterns, humidity and temperature, a more frequent weekly analysis is warranted if it is to be of predictive value in determining the seasonal trends and short-term fluctuations of vector populations.

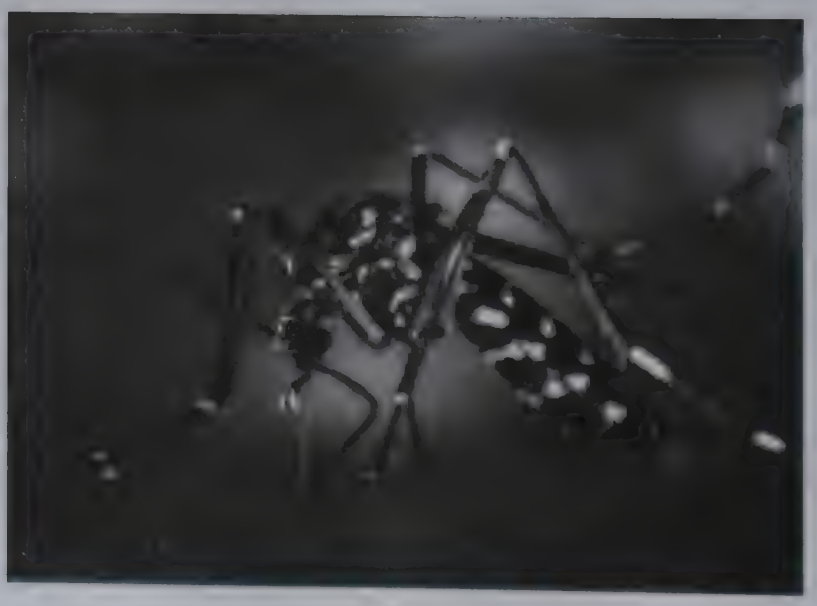
2.8 Pictures of different stages in mosquito life cycle

Eggs

Larvae

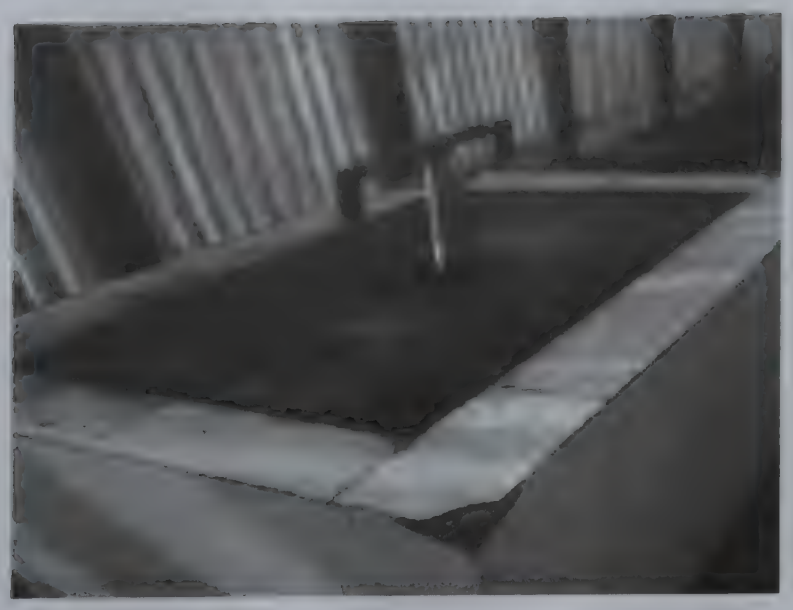
Pupa

Adult Aedes



Adult Aedes

2.9 Common breeding sites of aedes Mosquito



Chapter 3

Case management

3.1 Dengue fever

Clinical Manifestations:

Dengue fever is an acute febrile viral disease with clinical features that vary widely. It may present as an undifferentiated febrile illness with a maculopapular rash (often seen in children), a mild febrile syndrome similar to the flu, or the classical disease with two or more of the following manifestations: fever, headache, bone or joint pain, muscular pain, rash, pain behind the eyes, hemorrhagic manifestations (e.g., petechiae). In adults, recovery may be associated with prolonged fatigue and depression. During dengue epidemics, hemorrhagic complications may also appear, such as bleeding from the gums, nosebleeds, and bruising. It is very important to distinguish between DF with hemorrhagic symptoms and DHF so that appropriate therapy can be initiated in the case of DHF. Case fatality due to DF is very low, but case fatality due to DHF can be high. There is no specific treatment for DF beyond symptomatic treatment, rest, and rehydration.

3.1.1 Dengue hemorrhagic fever/dengue shock syndrome

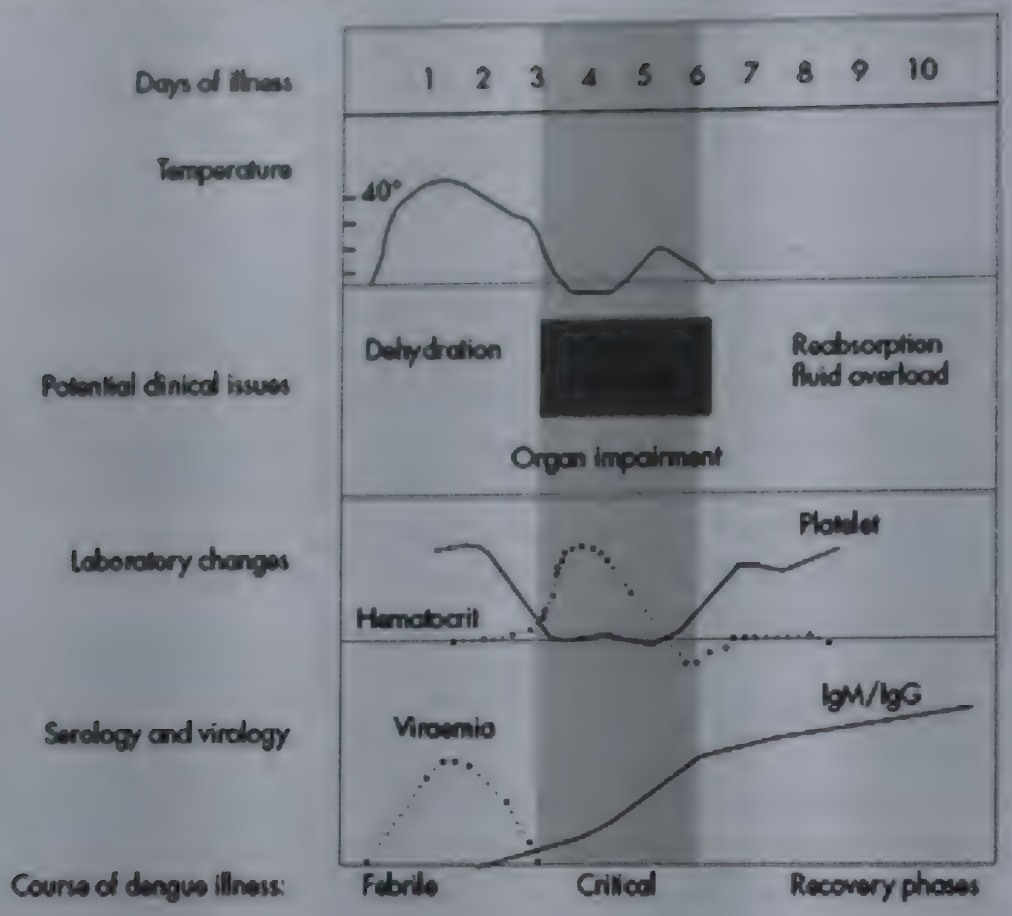
Cases of DHF are characterized by four clinical manifestations, all of which must be present: (1) fever or recent history of acute fever, (2) hemorrhagic phenomena (presence of at least one of the following: positive tourniquet test; petechiae, ecchymoses, or purpura; or bleeding from mucosa, gastrointestinal tract, injection sites, or others), (3) thrombocytopenia (100,000 mm3 or less), and (4) plasma leakage due to increased capillary permeability. Moderate to marked thrombocytopenia with concurrent hemoconcentration is a distinctive clinical laboratory finding of DHF. However, the major pathophysiological change that determines the severity of disease in DHF, and differentiates it from DF, is plasma leakage manifested by a rising hematocrit value (i.e., hemoconcentration).

The normal course of DHF lasts between seven and ten days, and with appropriate intensive supportive therapy—maintenance of the circulating fluid volume is the central feature of DHF case management—mortality may be reduced to less than 1%. In severe cases of DHF, the patient's condition may suddenly deteriorate after a few days of fever; the temperature will drop, followed by signs of circulatory failure; and the patient may rapidly go into a critical state of shock (dengue shock syndrome) and die within 12-24 hours, or quickly recover following appropriate volume replacement therapy.

Dengue shock syndrome (DSS) is the most severe form of DHF, and is characterized by the presence of all four DHF clinical manifestations as well as circulatory failure. All three manifestations of circulatory failure must be present: rapid and weak pulse, narrow pulse pressure or hypotension for age of patient, and cold, clammy skin and altered mental state.

The clinical presentations depend on age, immune status of the host and the virus strain. There are 3 phases seen in the illness:

The course of dengue illness*

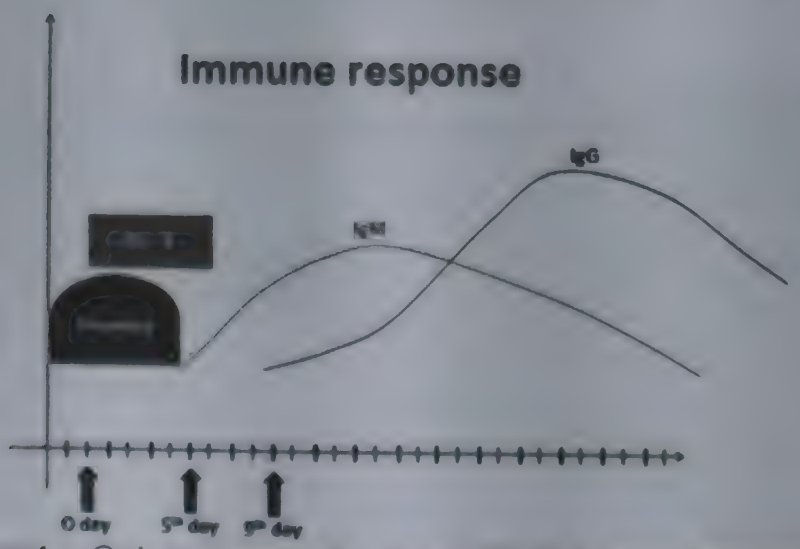


3.1.2 Laboratory Diagnosis

Early symptoms of dengue fever mimic other diseases often prevalent in areas where it is endemic, such as chikungunya, malaria and leptospirosis. rapid differential diagnosis is very crucial. Laboratory diagnosis can be carried out by one or more of the following tests:

a. Isolation of Dengue virus from serum, plasma, leucocytes or autopsy samples.
b. Demonstration of a fourfold or greater rise in reciprocal IgM antibody titres to one or more dengue virus antigen in paired sera samples.
c. Demonstration of dengue virus antigen in serum samples by ELISA or in autopsy tissue by immunohistochemistry or immunofluorescence.
d. Detection of viral genomic sequences in autopsy tissue, serum or CSF sample by PCR (Polymerase Chain Reaction)

The following diagram shows the relationship between immune response and selection of suitable tests.



3.1.2.1 ELISA based NS1 test - GoI recommends use of ELISA based antigen detection test (NS1) for diagnosing the cases from 1st day onwards and antibody detection test IgM Capture ELISA (MAC ELISA) for diagnosing the cases after 5th day of onset of disease for confirmation of Dengue infection.

The dengue virus has seven nonstructural protein (NS) genes. Following the bite of an infected Aedes mosquito, dengue virus replicates quickly before development of clinical signs or symptoms. The appearance of non-structural glycoprotein (NS1) coincides with increase of viraemia. The detection of NS1 antigen is therefore useful in early acute infection. Studies indicate NS1 antigen-detection assays have higher sensitivity during the first five days after onset of fever, thereafter decreases gradually and antibody-detection tests, have a higher sensitivity after day five of disease following onset.

3.1.2.2

IgM-capture enzyme-linked immunosorbent assay (MAC-ELISA)- MAC-ELISA has become widely used in the past few years. It is a simple, rapid test that requires very little sophisticated equipment. MAC-ELISA is based on detecting the dengue-specific IgM antibodies in the test serum by capturing them out of solution using anti-human IgM that was previously bound to the solid phase. If the IgM antibody from the patient's serum is anti-dengue, it will bind to the dengue antigen. An enzyme-substrate is added to give a colour reaction for easy detection.

The anti-dengue IgM antibody develops a little faster than IgG, and is usually detectable by day five of the illness. However, the rapidity with which IgM develops varies considerably among patients. Some patients have detectable IgM on days two to four after the onset of illness, while others may not develop IgM for seven to eight days after the onset. In some primary infections, detectable IgM may persist for more than 90 days, but in most patients it wanes to an undetectable level by 60 days. It is reasonably certain, however that the person had a dengue infection sometime in the previous two to three months. MAC-ELISA has become an invaluable tool for surveillance of DF/DHF/DSS. In areas where dengue is not endemic, it can be used in clinical surveillance for viral illness or for random, population-based serosurveys, with the certainty that any positives detected are recent infections. It is especially useful for hospitalized patients, who are generally admitted late in the illness after detectable IgM is already present in the blood.

3.1.3 Rapid Diagnostic tests

A number of Rapid Diagnostic Test (RDT) kits for anti-dengue IgM/IgG antibodies and NS1 antigen are at present commercially available, which produces the results within 15 minutes. However, the accuracy of most of these tests is not known since they have not yet been properly validated. Some of the RDTs have been independently evaluated. The results showed a high rate of false positive compared to standard tests, while others have agreed closely with standard tests. The sensitivity and specificity of some RDTs are also found to vary from lot to lot. The tests would thus be unreliable to guide clinical management.

Whenever the RDTs based on NS1 are used, care has to be taken for interpretation. Detailed guidelines have been issued regarding algorithm for selection of tests and interpretation. The RDT positives are reported separately as probable cases. A second sample is to be taken from that patient after 7-10 days to do the confirmatory test by MAC-ELISA.

3.1.4 Collection of Specimens

Laboratory diagnosis of dengue depends on proper collection, processing, storage and shipment of the specimens. While collecting blood for serological studies from suspected DF/DHF cases all universal precautions should taken. Samples could be collected

- As soon as possible after the onset of illness, hospital admission or attendance at a clinic (acute serum, S1).
- Shortly before discharge from the hospital or, in the event of a fatality, at the time of death (convalescent serum, S2).
- In the event hospital discharge occurs within 1-2 days of the subsidence of fever collect a third specimen 7-21 days after the acute serum (S1) was drawn (late convalescent serum, S3).

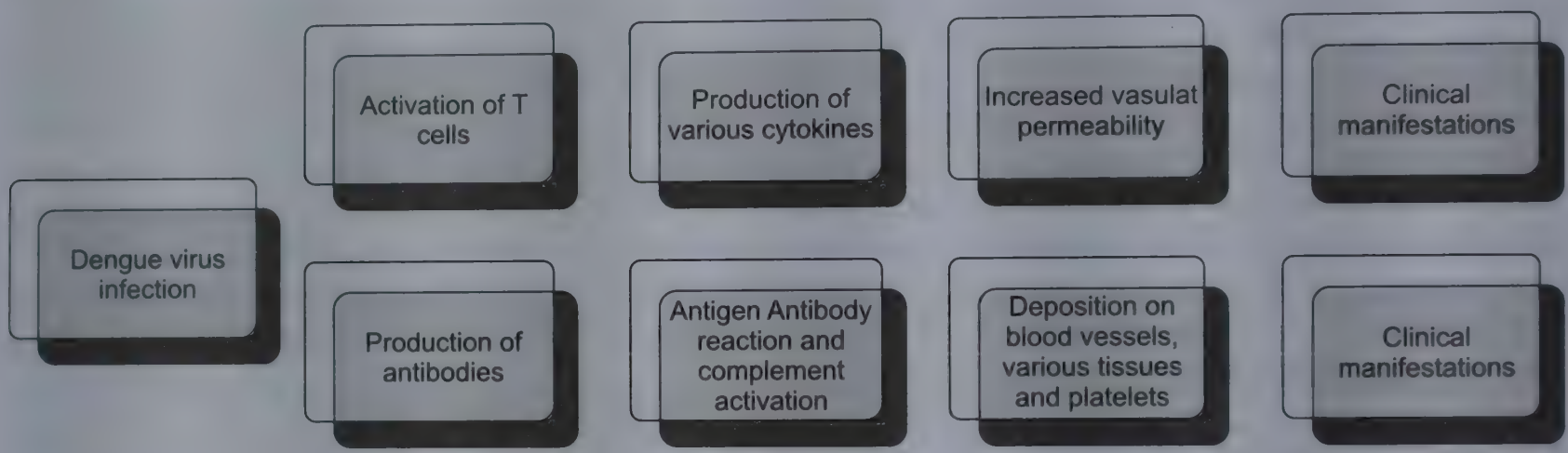
The optimal interval between the acute (S1) and the convalescent (S2 or S3) serum is 10 days. The above recommendations allow for the collection of at least two serum samples for comparison, and ideally will provide for an adequate interval between sera. Serological diagnoses are predicted on the identification of changes in antibody levels over time. Serial (paired) specimens are required to confirm or refute a diagnosis of acute flavivirus or dengue infection, whenever IgG ELISA is used. However a single sample in enough to conduct IgM ELISA.

While sending the samples for lab confirmation the day of onset of fever and day of sample collection should be mentioned to guide the type of test to be performed (NS1 for samples collected from day 1to 5 and IgM after 5days).

For details, refer NVBDCP laboratory manual for Diagnosis of Dengue and Chikungunya (www.nvbdcp.gov.in)

3.1.5 Management of Dengue cases

A proper understanding of the pathophysiology of dengue will facilitate better management which is explained below:[



The treating physician should consider the condition of the patient in totality and decide about management of an individual patient.

3.1.5.1 Grading the severity of dengue infection. To decide where to treat the patient, it is important to classify the severity of dengue infection as given in the **Table 6.** The presence of thrombocytopenia with concurrent haemoconcentration differentiates Grade I and Grade II DHF from DF.

3.1.5.2 Management of dengue fever. Management of dengue fever is symptomatic and supportive. Following advice is given to the patients.

1. Bed rest during the acute phase.
2. Use of tepid sponging to keep temperature below 39°C.
3. Antipyretics may be used to lower the body temperature. Aspirin/ NSAIDs should be avoided since it may cause gastritis, vomiting, acidosis and platelet dysfunction. Paracetamol is preferable in the following doses:
    a. 1-2 years: 60-125 mg/dose
    b. 3-6 years: 125 mg/dose
    c. 7-12 years: 250 mg/dose
    d. Adult : 500mg/dose

Note: In children the dose is calculated as 10mg/kg body weight per dose, which can be repeated at the interval of 4-6 hrs.

4.Oral fluid and electrolyte therapy are recommended for patients with excessive sweating or vomiting.

5. Patients should be monitored in DHF endemic area until they become afebrile for one day without the use of antipyretics and after platelet and haematocrit determinations are stable, platelet count is >50,000/cumm.

Table 6: Grading the severity of Dengue infection

DF/ DHF	Grade	Symptoms/ signs	Laboratory findings
DF		Fever with two or more of following - Headache - Retro-orbital pain - Myalgia - Arthragia	Leucopenia, thrombocytopenia
DHF	I	Above criteria for DF plus positive tourniquet test, evidence of plasma leakage	Thrombocytopenia: Platelet count less than 100000/cu.mm. Haematocrit rise 20% or more
DHF	II	Above signs and symptoms plus some evidence of spontaneous bleeding in skin or other organs (black tarry stools, epistaxis, bleeding from gums, etc) and abdominal pain	Thrombocytopenia platelet count less than 100,000/cumm Haemtocrit rise 20% or more
DHF	III	Above signs and symptoms plus circulating failure (weak rapid pulse, pulse pressure ≤20 mm Hg or high diastolic pressure, hypotension with the presence of cold clammy skin and restlessness)	Thrombocytopenia: Platelet count less than 100,000/cumm Haematocrit rise more than 20%
DHF	IV	Profound shock with undetectable blood pressure or pulse	Thrombocytopenia: Platelet count less than 100,000/cumm Haematocrit rise more than 20%

Note:

1. DF may sometimes present with bleeding manifestation but without evidence of heamoconcentration/plasma leakage. It should not be confused with DHF.
2. In addition pain and/or tenderness in upper abdomen have been commonly observed as prominent clinical feature.
3. Tourniquet test: The tourniquet test is performed by inflating a blood pressure cuff to a midpoint between the systolic and diastolic pressure for five minutes. The test is considered positive when 10 or more petechiae per 2.5 cm^2 are observed. In DHF, the test usually gives a definite positive test with 20 petechiae or more. **The test may be negative or only mildly positive during the phase of profound shock (DSS).**

If tourniquet test is found negative it should be repeated. Early diagnosis of disease and admission of DHF patients in hospitals are important in order to reduce case fatality rates. **Treatment can be initiated on clinical suspicion and on the basis of interpretation of platelet count and haematocrit. Confirmation by laboratory diagnosis is not required.**

3.1.5.3 Management of DHF (Febrile phase). The management of febrile phase is similar to that of DF. Paracetamol is recommended to keep the temperature below 39°C. Copious amount of fluid should be given orally, to the extent the patient tolerates. Oral Rehydration solutions (ORS), such as those used for the treatment of diarrhoeal diseases and/or fruit juices are preferable to plain water. IV fluid may be administered if the patient is vomiting persistently or refusing to feed.

3.1.6 READY RECKONER

In an outbreak situation where it is not possible to admit every patient it is important to prioritize and decide who needs hospital care the most. Following points are a guide to distinguish various situations and the action to be taken:

3.1.6.1 Dengue corner. Consider having a dengue corner in the hospital during transmission season which is functional round the clock with adequate trained manpower with facility for:

1. Tourniquet test
2. BP cuff of all sizes
3. Blood counter for complete blood count and haematocrit

3.1.6.2 Domiciliary management. Indications for domiciliary management are:

1. No tachycardia
2. No hypotension
3. No narrowing of pulse pressure
4. No bleeding
5. Platelet count >100,000/cumm

3.1.6.3 Follow up. Patient should come for follow up after 24 hours for evaluation. In case of the following complaints patient should report to nearest hospital immediately:

1. Bleeding from any site (fresh red spots on skin, black stools, red urine, nose bleed, menorrhagia)
2. Severe abdominal pain, refusal to take orally/poor intake, persistent vomiting
3. Not passing urine for 12 hrs/decreased urinary output
4. Restlessness, seizures, excessive crying (young infant), altered sensorium and behavioral changes and severe persistent headache
5. Cold clammy skin
6. Sudden drop in temperature

3.1.6.4 Admission: Consider admission of patient showing the following symptoms and signs:

1. Bleeding from any site
2. Persistent high grade fever(40°C and above)
3. Severe Abdominal pain, refusal to take orally/ poor intake, persistent vomiting, any signs of dehydration
4. Impending circulatory failure—tachycardia, postural hypotension, narrow pulse pressure(<20 mmHg, with rising diastolic pressure eg., 100/90 mmHg), increased capillary refilling time → 3secs (paediatric age group)
5. Neurological abnormalities - restlessness, seizures, excessive crying (young infant), altered sensorium and behavioral changes, severe and persistent headache.
6. Drop in temperature and/or rapid deterioration in general condition
7. Platelet count <20,000/cmm
8. Shock—cold clammy skin, hypotension/narrow pulse pressure, tachypnoea

Note: Patient may remain fully conscious until late stage

3.1.6.5 Lab investigations for assessment. Lab investigations necessary for all patients' assessment include CBC: Hb, Hct, TLC, DLC, platelet count and peripheral blood smear.

3.1.6.6 Lab investigations for diagnosis.

1. Antigen detection in serum samples by ELISA based NS1 on 1st 5 days of disease onset
2. Serology to be done on or after day 5 by Mac ELISA
3. While sending the sample to the laboratory do not forget to fill the laboratory requisition form along with the sample.
4. Mention the day of onset of fever and day of sample collection to guide the type of test to be performed (NS1 or IgM).

Note: In an outbreak all suspected patients of dengue need not undergo serology for purpose of clinical management)

Patients should be closely monitored for the initial signs of shock. The critical period is during the transition from the febrile to the afebrile stage and usually occurs after the third day of illness. Serial haematocrit determinations are essential guide for treatment, since they reflect the degree of plasma leakage and need for intravenous administration of fluids. Haematocrit should be determined daily from the third day until the temperature has remained normal for one or two days. If haematocrit determination is not possible, haemoglobin determination may be carried out as an alternative.

For detailed treatment for patients with DHF Grade I,II,III & IV refer National Guidelines for Management of DF/DHF/DSS 2007, also available at www.nvbdcp.gov.in) .

CHECK LIST OF DIAGNOSTIC AND THERAPEUTIC MATERIAL FOR DENGUE CASE MANAGEMENT

Minimum of diagnostic materials should be:

1. Blood pressure cuffs (adult and paediatric)
2. Thermometers
3. Haematocrit centrifuge
4. Haematocrit supplies (lancets, capillary tubes, reader)
5. Compound microscope and materials for white blood cell and platelet counts
6. Vacutainers or syringes/needles for obtaining dengue and diagnostic test samples

Minimum of diagnostic therapeutics:

1. Paracetamol
2. WHO oral rehydration solution
3. Lactate Ringer's solution; 0.9% saline; 5% glucose
4. Tubes and needles for intravenous therapy

Additional facilities for in-patients:

1. Laboratory test equipment and supplies for blood typing and cross-matching for measuring arterial blood gases and pH and for measuring serum electrolytes
2. Portable X-ray and ultrasound equipment
3. Central venous pressure monitoring kits
4. Intake-output monitoring charts

Therapeutic materials will be same as that of outpatient department plus:

1. Intravascular volume expanders (Dextran 40, plasmanate, platelet concentrates, fresh frozen plasma, whole blood)
2. 7.5% sodium bicarbonate for injection
3. Oxygen

3.1.6.7 Investigations for indoor patients.

1. Chest X Ray: Rt lateral decubitus one day after temperature drops
2. USG abdomen and Chest
3. Blood biochemistry: Serum electrolytes, Kidney function tests and
4. Liver function tests, if required
5. Stool examination for occult blood, pleural fluid tapping and blood culture for excluding other causes may be done.

3.1.7 Indoor management of patients

3.1.7.1. Indications of red cell transfusion

1. Loss of blood (overt blood)—10% or more of total blood volume. Preferably whole blood/component to be used
2. Refractory shock despite adequate fluid administration and declining haematocrit
3. Replacement volume should be 10 ml/kg body wt at a time and coagulogram should be done
4. If fluid overload is present PCV is to be given

3.1.7.2 Indications of platelet transfusion

1. In general there is no need to give prophylactic platelets even at <20,000/cumm.
2. Prophylactic platelet transfusion may be given at level of <10,000/cumm in absence of bleeding manifestations
3. Prolonged shock; with coagulopathy and abnormal coagulogram
4. When bleeding manifestations are seen
5. When internal bleeding is suspected
6. In case of systemic massive bleeding, platelet transfusion may be needed in addition to red cell transfusion.

Use of fresh frozen plasma/cryoprecipitate in coagulopathy with bleeding as per advice of treating physician and patient's condition.

As mentioned earlier, these are only broad guidelines. The treating physician should consider the condition of the patient in totality and decide.

3.1.8 Criteria for discharge of patients

1. Absence of fever for at least 24 hours without the use of anti-fever therapy
2. Return of appetite
3. Visible clinical improvement
4. Good urine output
5. Minimum of 2/3 days after recovery from shock
6. No respiratory distress from pleural effusion or ascitis
7. Platelet count > 50,000/cumm

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Bangalore - 34
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3.2 Chikungunya fever

Clinical features & case management

Chikungunya is a self limiting disease but its sequel could persist for months resulting in high morbidity. Compared to dengue fever, symptoms of Chikungunya are more irregular and insidious in origin. A classical triad of signs for CHIKV infection from every documented epidemic includes fever, arthralgia (often incapacitating arthralgia) and a rash that may or may not be accompanied by other indicators of the disease. CHIKV illness typically begins with a sudden onset of fever reaching as high as 104 °F that may last up to 10 days. The fever almost always precedes the rash and joint pain and has occasionally been reported as biphasic with recurrence noted on the fourth or fifth day of illness. Pain may remit for 2 – 3 days and reappear in a saddle back pattern. However, in the recent (2005–2007) outbreak, no reports of biphasic joint pains were noted. Non-pruritic rash is typically maculopapular and erythematous in character, starting 2–5 days post-infection, may last up to 10 days and is distributed primarily on the face, limbs and trunk of the body.

Most significant manifestation of CHIKV illness is the severe joint pain that occurs with virtually every clinical case. Name itself indicates the degree of discomfort caused: 'Chikungunya' in Makonde means 'that which bends up' or 'to dry up or become contorted'. Arthralgia is most commonly symmetrical and peripheral being noted in the ankles, toes, fingers, elbows, wrists and knees. Joints exhibit extreme tenderness and swelling with patients frequently reporting incapacitating pain that lasts for weeks or months. Paresthesia of the skin over the affected joints is common, suggesting neurological involvement, but no evidence of neurological sequel was documented in the early outbreaks. Most infections completely resolve within weeks or months but there have been documented cases of CHIKV-induced arthralgia persisting for several months with up to 12% of patients with CHIKV disease developing chronic joint problems.

Other symptoms reported with CHIKV infection include headache, retro-orbital pain, photophobia, lumbar back pain, chills, weakness, malaise, nausea, vomiting and myalgia. Some combination of these symptoms is generally reported by all patients but their presence and frequency are variable. Signs including conjunctivitis, pharyngitis and lymphadenopathy may be observed. Unfortunately, the symptoms of CHIKV infection are quite similar to those caused by many other infectious agents in the endemic areas. One particular difficulty in identifying CHIKV infection is its overlapping distribution with dengue viruses.

3.2.1 Atypical clinical presentations associated with CHIKV infection:

Occasionally, unusual CHIKV clinical presentation has been observed. For example, one individual with serological evidence of CHIKV infection during the outbreak in Sri Lanka in 1972 revealed evidence of myocarditis after acute febrile illness. Atypical clinical features have been of particular note in the 2005–2007 outbreaks, where descriptions of cases from Re´union Island have included neurological involvement in adults, foetuses and neonates. Laboratory studies have also shown the potential for neurological involvement. There has also been infrequent documentation of haemorrhagic manifestations including haematemesis and melaena due to CHIKV infection in South East Asia.

During the 1963–1964 outbreak in Calcutta, haemorrhagic manifestations of various grades of severity were documented. Eleven patients exhibited haemorrhagic symptoms; however, of the seven patients showing seropositivity to CHIKV, two exhibited a simultaneous rise in dengue virus antibodies and all survived. CHIKV was isolated from the remaining four patients; two of these died. However, there was no serological data to support CHIKV as the direct cause of the mortality. As in these early case reports, the potential complications of CHIKV co-infection with another virus infection such as dengue-2 virus may explain the recent deaths associated with CHIKV infection in Re´union and India. Haemorrhagic fever has also been noted in the Philippines, Bangkok and Re´union. While clinical cases with mortality, neurological disease or intrauterine transmission with possible teratology are not typical, they serve as a reminder that this virus may have diverse and perhaps evolving patterns of virulence that should be monitored as a public health prevention measure.

Clinically, laboratory parameters for CHIKV infections can also be quite variable and frequently do not aid in diagnosis. Results can include a normal haematocrit (varying from 40 to 50 %), thrombocytopenia or alternatively, no obvious platelet deficiencies, normal urinalysis and low to normal white blood cell counts of 4000–7000, although leukocytosis has been documented. The erythrocyte sedimentation rate may be slightly elevated, which is suggestive of rheumatoid arthritis and may confound diagnosis of isolated CHIKV infections. Overall, diagnosis is dependent upon isolation of virus or confirmation of virus-specific antibodies using acute and convalescent sera. Diagnosis is facilitated during large epidemics, while small rural outbreaks or individual cases are often never diagnosed.

Chikungunyua being an infection of a single genus it provides life long protection once the patient is infected. However, a case of chikungunya could show reappearance of symptoms after cure. This is due to the immunological response of release of antibodies with every new attack of fever subsequent to the primary infection. These are not relapses.

Mixed infections of chikungunya and dengue have been identified. This enhances the difficulty of diagnosis of chikungunya which share symptoms with dengue.

3.2.2 Case definition

Chikungunya should be suspected when epidemic occurs with the characteristic of abrupt onset of fever, arthralgia and myalgia, with or without rash.

Suspected case: a patient meeting the clinical criteria only
Confirmed case: a patient meeting both the clinical and laboratory criteria,

Clinical criteria:

- Acute onset of fever and severe arthralgia/ arthritis +/- rash and residing, or having left an epidemic area 15 days prior to onset of symptoms

Laboratory criteria:

- At least one of the following tests done in the acute phase of illness

Direct evidence

- ·Virus isolation / Presence of viral RNA by RT-PCR

Indirect evidence

- Presence of virus specific IgM antibodies in single serum sample collected in acute or convalescent stage.
- Four-fold increase in IgG values in samples collected at least three weeks apart.

Cases are to be categorized for the purpose of epidemiological reporting.

3.2.3 Laboratory diagnosis of Chikungunya

Routine laboratory diagnosis of Chikungunya includes demonstration of antibodies by serological methods, isolation of the virus and molecular demonstration of viral RNA. Isolation of the virus though considered a gold standard, is laborious and requires specialized laboratory setup.

Usually cases are diagnosed using simple laboratory tests for the demonstration of CHIKV specific IgM antibodies in patient's blood by ELISA. IgM antibodies appear as early as the 7th day of infection and may persist for at least 6 months after infection. This is a good test to detect cases in early and convalescent samples.

Viral isolation can be done using buffy coat of the patient's blood and growing the virus in cells lines such as BHK-21. HeLa and Vero cell lines. Cytopathic effect on the virus on the cell lines can be demonstrated. The virus can also be isolated using the *An. albopictus* C6/36 cells.

Diagnosis of Chikungunya may also be carried out using polymerase chain reaction. Chikungunya virus has a positive strand RNA. Generally Reverse Transcription polymerase chain reaction (RT-PCR) is used for the identification of the CHIKV. Detection is done through a standardized one – step single tube duplex RT-PCR to differentiate from DENV.

Real Time RT-PCR assay using one-step SYBR Green I has been described for detection and quantification of CHIKV in acute phase patient serum targeting E1 structural gene. Nucleotide sequencing of part of the E1 gene of CHIKV was used to investigate the relatedness of the samples.

3.2.4 Differential diagnosis:

1. Dengue – Dengue could pose a challenge in the diagnosis of chikungunya on clinical grounds. There is a great over lap of clinical presentation. However, symptoms are more dramatic in chikungunya. Myalgia is predominant symptom of dengue while it is arthralgia in chikungunya. Arthralgia in dengue though present is a less presenting symptom and may not persist for longer periods as in chikungunya. Other common symptoms of dengue namely suffusion of the eye, retro bulbar pain, bleeding tendencies is found occasionally in chikungunya. Haemo-concentration, thrombocytopaenia and leucopaenia are less expressed in chikungunya.
2. Rheumatoid arthritis – Rheumatoid arthritis also involves small joints as in the case of chikungunya. Rheumatoid arthritis is more a destructive arthropathy while bony destruction is seen only in a few chronic cases of chikungunya.
3. Symmetric psoriatic arthritis – Usually occurs 10 years after the cutaneous lesions are noted. It is associated with tendonitis.
4. Ross River Virus – This also causes arthritis like chikungunya and being an alpha virus manifestation are similar to that of chikungunya. However, it is not reported from India. Mainly upper limb is affected, joint swelling is prominent and the epidemics are not seen as with chikungunya.
5. Reiter's syndrome – This is a non reactive (immunologically associated) arthritis. Large joints are mainly affected. It occurs post infection but without any suppuration. It is associated with uveitis, conjunctivitis and urethritis. It is more common among age group of 20 -40 years, affecting both men and women. It is more common among whites due to the presence of HLA-B27.
6. Suppurative arthritis – This is a result of infection: (a) bacterial such as Staphylococcus, Streptococcus, Haemophyllus influenza, Niesseria, E. coli; (b) viral or (c) fungal. History of injury or infection pre-exists and could be associated with pus collection.
7. Spondilitis of low back – It is a progressive disorder finally resulting in restriction of movement due to bone fusion. This has to be differentiated when early manifestation could mimic the backache of chikungunya. X-ray gives a clue to the diagnosis.
8. Rashes are non-pruritic, maculopapular and erythematous and have to be differentiated form other rashes such as those resulting from other infections, allergic manifestations and drug induced which are mainly pruretic.
9. Other disease which requires to be ruled out includes Leptospirosis, malaria, brucellosis, etc.

3.2.5 Some important differences between dengue and Chikungunya

Table 7

Clinical features	Dengue	Chikungunya
Onset of symptoms	Fever develops first followed by other symptoms	Dramatic – the major symptoms appearing almost simultaneously
Joint pain (arthralgia)	May be present, usually non symmetrical	Major symptom and usually symmetrical
Joints affected	Usually knee, elbow, sholder, etc.	Usually small joint. Ankle, knee, elbow and hip joints may be involved
Myalgia	Most prominent sign	May be present but mild
Conjunctival suffusion	Present	May be present
Retro-bulbar pain	Present	May be seen in few cases
Leucopenia	Frequent	Rare. Usually at the lower end of normal
Thrombocytopenia	Frequent, especially with DHF and DSS	Not usually seen

3.2.6 Management:

Currently, there is no specific treatment for Chikungunya. Treatment is purely symptomatic. It is basically the use of non-salicylate analgesics and non-steroidal anti-inflammatory drugs (NSAIDs). CHIKV was highly sensitive to the antiviral activity of type I and II interferons. These results provide a general insight into the interaction between CHIKV and its mammalian host.

Drug of choice is Tab. Paracetamol (500 mg 6th hourly). Children may be administered 50 – 60 mg per Kg body weight of paracetamol. In the active phase of the disease it is better to avoid the use of other drugs and use of heat. After the acute phase, NSAID drugs could be used to manage pain. Tepied sponging could be used to treat hyperpyrexia and joint swelling and inflammation. Whenever NSAID is used, to prevent gastric irritation and bleeding H2 antagonists such as ranitidine 150 mg twice daily or proton pump inhibitors like omeprezole 40 mg once or twice daily may be used. Tab. Chloroquine has been found to be effective. A dose of 300 mg. chloroquine phosphate daily for 10 -15 days is recommended. DHQ can also be used.

Drugs to be avoided include salicylates and steroids. Co-infection with dengue should be kept in mind. Drugs contraindicated in the management of dengue should also be avoided till dengue co-infection is ruled out.

Rest is recommended for the acute stage of the illness. Mild exercises could be started after the acute phase. Strenuous exercises should be avoided.

Chapter 4

Prevention and control of dengue / chikungunya:

4.1 Concept:

There is, as of now no anti-viral drug for treatment or chemoprophylaxis of dengue and chikungunya. The vaccine is still under development. Therefore the main prevention and control strategy of dengue / chikungunya is in interrupting the transmission of the virus from one person to another. The strategy is applicable in two types of settings:

1) Long term measures to be done in all the months of the year
2) Containment of outbreaks

4.2 Long term measures:

Anti adult measures against Aedes aegypti have significant limitations. Insecticidal Residual Spray with DDT / Malathion / Synthetic pyrethroids have limited effect because it would be very difficult to achieve a thorough coverage inside a house reaching every nook and corner where the aedes would be resting. Outdoor fogging with technical malathion is essentially useless as the aedes are indoor resters. Therefore antilarval measures are the mainstay of vector control. Anti-larval measures are broadly categorized into source reduction, biological and chemical methods. For dealing with aedes, source reduction measures are the most relevant methods.

4.2.1 Source reduction methods:

Source reduction methods are defined as anti-larval operations causing the reduction or permanent elimination of mosquito breeding places or sites. Source reduction primarily aims to prevent development of aquatic stage of mosquito larvae by reducing breeding source. These methods are environment friendly, economical in the long run with minimum maintenance and surveillance. Source reduction measures undertaken would not only solve the problem of malaria and other vector borne disease in an area but also would bring socio-economical and financial benefits, general well-being of communities and overall environmental up-gradation.

Egg laying in suitable breeding habitats is the first step in the life cycle of mosquitoes. It takes about a total of 10 days for the eggs to hatch into larvae, for the development of larvae to pupae and for the adult to emerge from pupae. If water is not allowed to stagnate for more than one week in any domestic container or peridomestic potential breeding site, the development of the aquatic stage can be interrupted resulting in no or less aedes breeding. This is the very objective of source reduction.

Throwing of disposable/used tea cups, glasses, buckets, tyres utensils is a very common habit of the community particularly in residential settlements, irrespective of slums or organized localities. During monsoon and post monsoon months these small containers become ideal potential breeding sources for Aedes vector mosquitoes. Open tanks overhead and underground tanks, unused wells in urban, peri-urban or semi-urban locality are also potential breeding source for vectors of malaria, dengue and chikungunya. Storage of potable water has been a common practice in both urban and rural areas. Construction sites also have high breeding potential. Concrete roof and terrace without proper drainage may lead to water collections, during monsoon months forming breeding sites.

Emptying of water containers once a week, drying them for a while and then re-use would prevent the aedes breeding to a great extent.

Comprehensive source reduction activities should involve communities, residential welfare associations, etc so that every house is kept free of mosquito breeding.

It is also important to realize that public buildings also are a significant sources of aedes breeding since they are usually uncared for or are badly supervised. Schools, hospitals, movie theatres, shopping malls, government buildings, religious places etc may have water storage facilities and containers which can breed aedes.

The following steps are suggested for implementation of source reduction methods:

- Never to throw any containers in open
- Overhead tanks and underground tanks must be checked and maintained on a weekly basis. They should be covered properly not allowing the access to mosquitos.
- Open tanks used for animals should be emptied and dried once in a week.
- Construction sites require special attention. Water storage tanks should be inspected weekly and emptied weekly. Curing process with water for concrete allows mosquito breeding. Drying them for an hour every week is necessary. Otherwise larvicides can be applied on weekly basis. Building bye-laws, must be implemented to prevent faulty designs.
- Ornamental tanks, fountains should be checked periodically and and emptied once a week.
- Public health engineers should be involved for proper drainage, building designs, periodic flushing of water logged areas and drainage.
- Stagnant water in buckets, discarded tyres, dumped items in junk yard should be drained out or disposed before monsoon to discourage mosquito breeding.

Source reduction measures in specific situations:

a. Draining water supply installation

Water collection/leakages in masonry chambers, distribution pipes, valves, sluice valves, surface boxes for fire hydrants, water meters, etc. that serve as important Ae. aegypti larval habitats in the absence of preventive maintenance should be provided with soak pits.

b. Covering domestic water-storage containers

The major sources of Ae. aegypti breeding in most urban areas are containers storing water for household use, including clay, ceramic and cement water jars, metal drums and smaller containers storing fresh water or rainwater. Water storage containers should be covered with tightly fitting lids or screens and care should be taken to replace them after water is used.

c. Cleaning flowerpots/vases and ant-traps

Flowerpots, flower vases and ant-traps are common sources of Ae. aegypti breeding. Water that collects on the saucers that are placed below flowerpots should be removed every week. Water in flower vases should be removed and discarded weekly and vases scrubbed and cleaned before reuse. Alternatively, live flowers can be placed in mixture of sand and water. Ant-traps to protect food-storage cabinets should be cleaned on a weekly basis and treated with common salt or oil.

d. Cleaning incidental water collections

Desert (evaporation) water-coolers, condensation collection pans under refrigerators, and airconditioners should be regularly inspected, drained and cleaned. Desert water-coolers generally employed in arid/semi-arid regions north India to cool houses during summer contain two manufacturing defects. The exit pipe at the bottom of the water-holding tray is generally fixed a few centimetres above the bottom. This exit pipe should be fitted at such a level that while emptying the tray, all the water should get drained off without any retention at the bottom. Desert coolers are normally fitted to windows with the exit pipe located on the exterior portion of the tray. These sites are usually difficult to access, and therefore, there is a need to change the design so that both the filling and emptying of the water-holding trays can be manipulated from the room, thus eliminating the need for climbing to approach the exit pipe from the exterior of the building.

e. Managing construction sites and building exteriors

Water-storage facilities at construction sites should be mosquito-proof. Housekeeping should also be stepped up to prevent occurrence of water stagnation. The design of buildings is important to prevent Aedes breeding. Drainage pipes of rooftops, sunshades/porticos often get blocked and become breeding sites for Aedes mosquitoes. Roof gutters of industrial/housing sheds also get similarly blocked. Where possible, the design of such features should minimize the tendency for mosquito breeding. There is a need for periodic inspection of such structures during the rainy season to locate potential breeding sites.

f. Managing mandatory water storage for fire-fighting

Fire prevention regulations may require mandatory water storage in some countries. Such storage tanks need to be kept mosquito-proof. These drums should be kept covered with tight lids; failing which larvivorous fish or temephos 1 PPM can be used.

g. Managing discarded receptacles

Discarded receptacles - namely tins, bottles, buckets or any other consumable packaged items such as plastic cups/trays and waste material, etc. scattered around houses - should be removed and buried in landfills. Scrap material in factories and warehouses should be stored appropriately until disposal. Household and garden utensils (buckets, bowls and watering devices) should be kept upside down to prevent accumulation of rain water. Similarly, in coastal areas canoes and small boats should be emptied of water and turned upside down when not in use. Plant waste (coconut shells, cocoa husks, etc.) should be disposed of properly.

h. Managing glass bottles and cans

Glass bottles, cans and other small containers should be reused, recycled or buried in land fills.

i. Tyre management

Used automobile tyres are of significant importance as breeding sites for Aedes, and are therefore a public health problem. Imported used tyres are believed to be responsible for the introduction of Ae. Aegypti and Ae. albopictus into newer areas. Tyres in depots should always be kept under cover to prevent collection of rainwater. Discarded tyres can be cut in pieces, heaped in a place and covered. Otherwise holes may be drilled in tyres. They can be filled with sand. New technologies for tyre recycling and disposal are continually coming into use, but most of them have proved to be of limited application or cost-intensive. It is recommended that each community should look at ways to recycle/reuse used tyres so that they do not become breeding habitats.

j. Filling up of cavities of fences

Fences and fence-posts made from hollow trees such as bamboo should be cut down to the node. Concrete blocks should be filled with packed sand or concrete to eliminate potential Aedes larval habitats.

k. Managing public places

Municipalities should have in place a programme to inspect and maintain structures in public places such as street lamp posts, park benches and litter bins that may collect water if not regularly checked. Discarded receptacles that may hold water, such as plastic cups broken bottles and metal cans, should be regularly removed from public areas. A nodal officer should be identified for every major public building who is responsible for periodic inspection of that building. He should be responsible for keeping the building free of mosquito breeding.

The following table shows the specific actions for particular breeding sites:

Table 8

Production site	Empty, clean scrubbed weekly	Mosquito proof cover	Puncture or drain/store under roof	Collect, recycle/ dispose	Fill (sand/soil)
Water storage tank	+	+			
Drum	+	+			
Desert cooler	+				
Used tyres			+	+	+
Flower vase with water	+				
Roof gutter/sun shades	+				
Potted plants with saucers	+				
Ornamental pool/fountain	+				
Animal water container	+				
Ant-trap	+				
Discarded junks			+	+	
Discarded food & drink containers				+	
Disposable cups/glasses				+	
Tree holes					+
Rock holes					+
Rubber collecting cups	+			+	
Fruit shells				+	
Shoot of palm leave				+	
Bamboo stumps				+	+

4.2.2 Specific activities to be taken up in different districts:

4.2.2.1 Aedes survey:

In every panchayat area aedes survey is to be taken up at least thrice a year. In selected villages house to house survey is taken up by a team of ASHA and ANM / Male MPW. Every house is inspected to locate potential and actual breeding sites of aedes.

Before such survey, ASHA and ANM / Male MPW are to be trained by Assistant entomologist of the district level, DVBDCO, DSO etc in the actual process of search for breeding sites of aedes. They should be provided torches and battery cells. ASHA is also provided honorarium for the household survey.

After the survey the data for the village is compiled in a tabular form, as shown below, so that the extent of aedes breeding can be measured. Various larval indices can be calculated.

Table 9

TALUK	PHC	Name of villages Surveyed	Date	No of houses	Indoor Breeding Sites												Out Door Breeding Sites																				Nos of Containers Source reduction done	Nos of notifiation applied with Larvicide	Total Houses found prone for larvae	Container Index	House Index	Breteau Index
					Cement tanks		Plastic Barrels		Drums		Earthen Pots		Others				Solid waste								Others															
													Tin Containers		Stone Tanks		Glass materials		Plastic materials		Grinding Stone		Coconut Shell		Tyres		Stone Tanks		Cement Tanks		Plastic Barrels		Drums		Earthen Pots		Flower pots		Tap pits							
					$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+	$	+						
	Dist Total																																											

4.2.2.2 Advocacy activity:

After the survey, on the same day, a focus group discussion is to be held in the same village. The larvae collected are shown to the people. The breeding sites are shown. It should be emphasized that by allowing breeding of aedes in and around their houses, they become responsible for spread of dengue and chikungunya. Source reduction measures applicable to different types of breeding places are demonstrated. Area specific and locally applicable actions are taken. Weekly inspection of surroundings are to be conducted by the people.

4.2.2.3 Solid waste management:

While the people may take responsibility for taking care of the breeding places in their households, it is difficult to manage the outdoor breeding places. Panchayats have to assume responsibility for the same. Village Health and Sanitation Committee (VHSC) has to take an active role in this direction. It may be worthwhile to supplement their efforts in dealing with breeding places in public space. Limited funds are being allocated for hiring daily wage workers to empty such water containers and dispose off some small containers.

While the funds from the Joint Director (NVBDCP) may be utilized for the aedes surveillance and source reduction in selected panchayats, instructions have been issued by Mission Director (NRHM) to utilize the untied funds at various levels in other panchayat areas.

4.2.2.4 Implementation of civic byelaws:

Civic byelaws are in place for prevention of mosquito breeding in commercial buildings, cinema theatres, shopping malls, buildings under construction etc. These byelaws should be effectively implemented. Nodal officer should be identified for any major establishment. This person is responsible for periodic inspection of the building premises for aedes larval survey and necessary containment measures.

4.2.2.5 School health education campaign:

In collaboration with the education department, school health education campaign is to be taken in all government and private educational institutions. A team of health workers may visit schools and take up lecture and practical demonstration regarding various aspects of dengue prevention and control. The live aedes larvae have to be shown to the teachers and children. Common breeding places in school surroundings and houses may be shown. A project may be given to students to inspect their houses and surrounding areas and find out mosquito breeding places. Debate / essay competitions, poster development competition etc may be held.

4.2.2.6 Behaviour change communication activities:

Interpersonal communication methods are the most effective. It is the duty of all health personnel to personally communicate with people regarding the source reduction activities to be taken up at household level.

Focus group discussions are to be conducted in all villages / urban areas.

Mass media activities through cable TV, radio, newspapers etc are required round the year. July is observed as anti dengue month with an objective of conducting a multi-media campaign.

4.2.3 Personal protection methods:

Use of repellents, mosquito coils and aerosols is helpful. Citronella oil, lemon grass oil and neem oil are natural oils from plant extracts which can be safely used as repellents. Chemical repellents like DEET (N, N- Diethyl- m-Toluamide) can offer protection for several hours. However it should be kept in mind that aedes are day biters and these methods are effective when used during day time. Mosquito nets if used during day time do offer protection. For pregnant women, young children, senior citizens may protect themselves with these methods. Adequate, loose and thick clothing reduces risk of mosquito biting. Long sleeves and trousers may protect if worn regularly.

4.3 Containment of outbreaks:

4.3.1 Investigation of an outbreak of Dengue /Chikungunya:

Study of information as provided in the prescribed formats of passive or active surveillance would lead to detecting a potential outbreak of Dengue /Chikungunya. Periodic analysis of M2 formats being received from different subcenters would indicate any sudden increase in the number of fever cases. Form S of IDSP would mention the number of fever cases during a week. It would also mention the number of fever cases with rash. The MPWs are also expected to convey information of any significant increase in the number of fever cases seen by them in any village to District Vector Borne Disease Control Officer (DVBDCO) and the District Surveillance Officer (DSO). They also should send a formal First Information Report.

Rise in the number of fever cases in the outpatient department of PHC /CHC / District hospital might be the earliest indicator of an outbreak in the catchment area. Form P of IDSP would indicate the number of suspected dengue cases seen at the PHC during that week. Medical officers in the outpatient department need to identify such an event and find out the area from which the increased numbers of fever cases are coming. Such information has to be provided to the district surveillance officer / district malaria officer immediately along with clinical suspicion regarding the cause of fever. Media may also be a source of such information.

An Emergency Action Committee should be constituted under the Chairmanship of District Collector or Municipal Commissioner to co-ordinate activities aimed at emergency vector control measures and management of serious cases. Their functions include:

- To take all administrative actions and coordinate activities aimed at management of serious cases in all medical care centres and undertake emergency vector control measures.
- To draw urgent plans of action and resource mobilization in respect of medicines, intravenous fluids, blood products, insecticides, equipment and vehicles.
- To liaise with intersectoral committees to mobilize resources from non-health sectors, namely Urban Development; Ministry of Education, Ministry of Information; Legal Department; Water Supply; Waste Disposal and Information for elimination of breeding potential of *Ae. aegypti*.
- To interact with the news media and NGOs for dissemination of information related to health education and community participation.

Rapid Response Team (RRT) at the district level is to be constituted to undertake investigation of the outbreak. The RRT should have the District Vector Borne Disease Control Officer (DVBDCO) as the head. The team members are entomologist, microbiologist, laboratory technician, Senior Health Inspector, MPW etc. RRT is to undertake urgent epidemiological investigations and provide on the spot technical guidance required and logistic support. Their functions include:

- Undertake urgent epidemiological and entomological investigations.
- Provide required emergency logistical support, e.g. delivery of medical and laboratory supplies to health facilities.
- Provide on-the-spot training on case management for local health staff.
- Supervise the elimination of breeding places and application of vector control measures.
- Carry out health education activities.
- Collection of serum specimens.

The RRT would take with them adequate number of slides, aliquots, lab requisition forms, cotton, spirit etc.

The first step in the outbreak investigation is the rapid fever surveillance by household visit. All fever cases are identified. A blood smear is taken from all the fever cases to rule out malaria. 2 -5 ml of blood is to be taken for dengue diagnostic test. If the number of fever cases is many, there is needed to take blood samples from only a sample of cases (about 5 – 10 % fever cases). A line list of all fever cases is to be prepared to facilitate analysis. A suggested format for the line list is as follows:

Sl. No	Name of the patient	Age	Sex	Presenting symptoms and their duration	Blood smear Blood sample number	Provisional diagnosis	Treatment given

4.3.2 Management of fever cases: It is imperative that initial treatment of all fever cases be undertaken at the village itself. A clinic has to be established in the affected village providing round the clock services. a medical officer / physician / paediatrician should be available in the clinic with staff nurse. All fever cases are examined and provisional diagnosis is made for each case. All possible causes of fever are considered in differential diagnosis. This is important because there can be more than one disease in that outbreak.

Treatment for each case is to be started depending on the provisional diagnosis. For suspected cases of dengue, symptomatic treatment with paracetamol is to be started and supportive treatment is to be given as outlined in Chapter 3.

Collection of proper sample is very important to confirm the cause of the outbreak. First thing is to rule out malaria by taking a blood smear from every fever case and examining the smears on the same day. Positive malaria cases, if any, have to be treated appropriately.

From suspected cases of dengue 5 ml of blood is to be taken. Venous blood is collected and placed in a sterile test tube. Let the specimen clot for 30 minutes at ambient temperature. Then place in a cool box for clot retraction at 4 – 8°C, for a minimum of 1 – 2 hours. This is then centrifuged @ 1000 G for 10 mts. Separate the serum from the clot and transfer to a sterile screw capped plastic leak proof specimen container. The containers should be labeled before commencement of venepuncture. Sera should be kept and then transported at 4 – 8°C (cold chain). At this temperature the sample can last for up to 10 days. Otherwise it should be stored in deep freezer.Other precautions that should be taken are that any blood spill is carefully wiped with 70% ethanol and that all the swabs and cotton pieces are placed in plastic bags for disposal. If the outside of the vial is visibly contaminated with blood, it should be cleaned with 10% freshly prepared sodium hypochlorite solution.

Case investigation and laboratory request form as below should accompany each sample:

Date	
Patient's name	
Name of head of the household	
Address	
Age	
Sex	
Date of onset of illness	
Presenting symptoms and their duration	
	Fever: __ days Rash: __ days Bodyache: __ days Others:
Provisional diagnosis	
Date of collection of the sample	
Tests required	
Any other relevant information	
Details of the sender	
Signature	

Whenever the number of fever cases is more in number, it should be noted that specimens need not be collected from all but only from a representative sample of fever cases (5 to 10 %). If the number of samples is high the laboratory may not be in a position to test all of them in view of limited kits being available. Taking specimens from all is also not relevant because confirmation of diagnosis of dengue in each case does not determine the treatment. Since there is no specific antiviral treatment for dengue and since the treatment is symptomatic and supportive, testing is not for individual treatment but it is for surveillance and control measures.

4.3.3 Entomological survey of all the houses and peri-domestic areas is to be taken up as soon as possible. In every house and the surroundings, potential and actual breeding places of aedes should be noted. The data is tabulated as in annexure 6.4.

4.3.4 Emergency Vector control Measures should be taken up as follows:

- Indoor space spraying – using 1:19 (2 %) pyrethrum
- Outdoor space spraying
  - using Ultra Low Volume (ULV) organophosphorous compounds
  - Thermal Fogging – insecticide of choice for fogging is malathion/pyrethrum
- Larval Control measures – consisting of source reduction, use of chemical and biological larval control measures, following dry day, water management, etc.

4.3.4.1 Indoor space spraying:

Indoor Pyrethrum ultra low volume spray application is to be undertaken on weekly basis for maximum 3 rounds. Indoor space spray may be considered only if operationally feasible (as a contingent measure for containing outbreak) in situations of high densities of mosquitoes and clustering of cases in the area. It has to be used as a supplement to other vector control measures for a limited period.

2% Percent Pyrethrum is commercially available. This extract is diluted in kerosene/diesel in a ratio of 1:19. Thus one litre 2 % pyrethrum is diluted by kerosene into 20 litres of 1 % pyrethrum extract "ready to spray" formulation. One liter of such solution is enough to cover 20 households, each household having 100 cubic meters of indoor space. It may be mentioned here that in spite of many years of use, no resistance of the mosquito to pyrethrum has been seen.

For indoor application, Flit pumps or hand-operated aerosol applicators/portable aerosol generators and mist-blowers are recommended. For best results, the application is to be done in early mornings and late evenings.

Operation and maintenance of equipment and safe handling:

All equipment must be inspected and damaged or loose parts be replaced immediately. The equipment should be tested in simulated condition. It should be cleaned and dried. A proper record should be maintained for the equipment and spares. All personnel using, or supervising the operations must be properly trained in operation and maintenance including routine techniques essential for maintenance after day's operation.

Removal and safe disposal of any insecticide remaining in the equipment:

- Thorough flushing of equipment at least 3 times with clean diluents. The rinsing may be kept safely for future use while diluting technical grade insecticide with diluents subsequently.
- Careful inspection of equipment and reporting of any damaged/defective or missing part for immediate repair/replacement.
- Check availability of appropriate tools and spares.

The operators should be properly trained in safe handling of insecticides and application equipment and should strictly follow the safety precautions. All equipment used should conform to general and specific recommendations with regard to design and maintenance. Equipment with appropriate quality standards and specification should only be used. Regular systematic inspection should be done to ensure that there is no leakage from faulty valves, gaskets or hoses etc.

4.3.4.2 Outdoor fogging:

Foggingis an aerosol spray having a distribution of droplets with a Volume Median Diameter (VMD) in the range of below 50 microns (mostly 5-15 microns), and where the number of droplets per unit volume is such that visibility is reduced. Fogging has been listed as the last option in chemical control methods because of the limitations associated with this strategy that include: Temporary stay of fog in the environment with no residual effect, Effect primarily on adult mosquitoes that come in contract of the fog, Repeated application needed, High costs, Effect on vectors highly dependent on climatic factors like wind velocity and its direction, humidity, temperature etc., Speed of the movement of fogger carrying vehicle or spray men, Dispersal of fog, Quality of fogging equipment etc. Good planning and management, training of operators in application technique, and the efficient calibration and use of equipment are crucial factors for attaining proper insecticide application.

Thermal fogging is based on the principle that insecticide is vaporized, which condenses to form a fine cloud of droplets on contract with cooler air when it comes out of the machine. The insecticide is vaporized at a very high temperature inside the machine. Once the fog comes out of the machine, it tends to spread in different directions by mixing with wind. The insecticide of choice for fogging is Malathion/Pyrethrum extract because of relative lower mammalian toxicity. Being biodegradable these do not persist in environment for longer durations. Thermal fogging is psychologically more acceptable as it generates a highly visible fog. The most common and preferred types of equipment include portable thermal fogger and mist blowers. Vehicle mounted machines have limitation of their use restricted to areas with communicable roads only.For thermal fogging5 percentMalathion in kerosene/diesel (1 litre of technical Malathion in 19 litres of diluents) is to be used. The most suitable time is the evening and early mornings when relatively suitable climatic conditions exist and the mosquito vectors are most active.

The application rate of insecticide with most of this equipment is generally <0.5 litres per hectare and requirements can be worked out on this basis. Mostly the effective application is about 330 ml per hectare; however, it varies with type of machine used.

Though thermal fog has advantage of being visible, the disadvantages outweigh this aspect:

- Sufficient concentration in the air cannot be achieved indoor whereby exposure of adult mosquitos to the chemical is not sufficient
- Formulation contains large volume of diluents (organic solvents) which make operation expensive due to high cost of solvent and application
- Thick fog causes reduced visibility and traffic hazards
- Burning of large volumes of diluents may not be environment friendly
- Very high temperatures of machine operations and use of organic solvents (highly inflammable) poses serious risk of fire hazards.

Therefore there is no significant role of outdoor fogging in aedes control.

4.3.4.3 Larval Control measures; Treatment of domestic storage water with temephos for control of aedes mosquito breeding:

1. Introduction:

The ideal method for control of Aedes mosquito breeding is source reduction or storing the water in mosquito proofed containers. Wherever it is not possible to implement the above methods, the alternative method is to treat the Aedes breeding source with Temephos, which possesses very low mammalian toxicity. It is an organophosphorus larvicide which is used for control of mosquito breeding in towns under UMS/NFCP. Temephos was successfully used in India for treatment of drinking water sources like step-wells, ponds, tanks, etc. during Guinea-worm Eradication Programme. The recommended dose is 1 ppm (parts per million). Since many areas in India are in the grip of Dengue Chikungunya outbreaks, it is recommended to supplement the vector control measures through recurrent antilarval measures using temephos, wherever source reduction is not feasible.

2. Preparation of 'Stock Solution' of Temephos and Treatment of Stored Water:

Essential Material and Equipment required:

(i) Temephos (50% EC)
(ii) 2 ml capacity leak proofed screw-capped plastic vials,
(iii) 10 ml plastic measuring cylinder,
(v) 100 ml plastic measuring cylinder and
(v) one litre capacity empty mineral water bottle.

Optional Equipment:

(i) One foot plastic scale or tailor's measuring tape,
(ii) 15 litre capacity plastic bucket with markings to measure the volume of water, and
(iii) one litre capacity plastic mug.

Methodology:

Step 1: 2 ml quantity of Temephos (50% EC) is measured exactly with a syringe into the 2 ml capacity plastic vial and closed tightly with leak proofed screw cap. The number of viais will depend on the requirement of day's work. The filled plastic vials are to be carried by the health worker to the field on every working day.

Step 2: This step to be carried out in the field. Fill the one litre capacity empty mineral water bottle with tap water or potable water approximately up to 900 ml. Pour the contents of temephos from the 2 ml vial into the one litre capacity bottle. Rinse the plastic vial twice with water and empty the contents again into the one litre capacity bottle. Screw the cap tightly and mix the contents thoroughly. Now fill the one litre bottle slowly and carefully with tap water so that the stock solution is made exactly up to one litre. Do not fill the bottle directly from the tap to avoid spillage or overflowing of stock solution from the bottle. Now the stock solution strength is 0.1% temephos active ingredient or in other words the strength of stock solution is 1000 ppm.

Step 3: Estimate the contents of domestic stored water to be treated with stock solution. Treat the stored water @ 1 ml of stock solution per 1 litre of stored water. Suppose the stored water is 8 litres, measure 8 ml of stock solution into 10 ml capacity measuring cylinder and pour the contents into the sored water and stir the water thoroughly so that stock solution mixes immediately. If the stored domestic water is 25 litres, measure 25 ml stock solution into 100 ml capacity measuring cylinder, pour into the stored domestic water and mix thoroughly. The water in coolers, flower pots and other breeding sources are to be treated similarly.

3. Frequency of Treatment:

Once a week. It is similar to routine working schedule followed for anti larval measures, each area is to be visited on the assigned working day, so that frequency of weekly treatment is followed. Records are to be maintained with stencil markings about the date and number of potential breeding places treated.

4. Calculation of stored domestic water:

If the water storage tank is in rectangular shape. take the inside measurements of length, width and depth of stored water (note the container's height) using plastic scale or measuring tape in centimeters and use the following formula to calculate the volume in litres.

$$\frac{\text{inside length x inside width depth of water}}{1000} = \text{x litres of water}$$

Illustration:

$$\frac{\text{90 cm length x 50 cm width x 60 cm depth}}{1000} = \text{270 litres of stored water}$$

For treating the contents of the stored water illustrated above. pour 270 ml stock solution using 100 ml capacity measuring cylinder. Measure the stock solution thrice i.e. 100 ml + 100 ml + 70 ml if the stored water container is in cylindrical shape, use the following formula:

$$\frac{\Pi\, r^2 h}{1000} = \text{X litres of water}$$

Where 'r' is radius and 'h' is depth of water and Π can be considered as 3.1 or 3.14
Measure inside diameter of the container in centimeters and divide by 2 which gives radius

Illustration:

$$\frac{\text{3.1 x 30 cm radius x 30 cm radius x 50 cm depth of water}}{1000} = \text{13.5 litres or 140 litre}$$

Measure 140 ml stock solution using 100 ml measuring cylinder. Measure the stock solution twice i.e. 100 ml + 40 ml. (The above volume is rounded off to 140 litres, since the actual value of Π is 3.14, when second decimal point is used. The diameter is 60 cm and hence the radius becomes 30 cm while r^2 is calculated as 30 cm x 30 cm). For semicone containers, take mean value of radius if top and bottom levels of water.

For irregular shaped containers where one is not sure of the volume of water, measure contents in the 15 litre capacity bucket.

5. Precautions: (i) While measuring 2 ml temphos in the plastic vials, use rubber gloves and face mask as recommended by the manufacturers. (ii) The plastic vials and one litre water bottles should be leak proofed. (iii) The one litre water bottles should be labeled with glass making indelible sketch pns on both sides of the bottle as "Danger: 0.1% Temehos. Do not use the bottle for storing drinking water" (iv) After day's work, the left over contents of stock solution are poured into a running drain and wash the bottles and other equipment thoroughly for the next day use. (v) Destroy the one litre water bottles after the cessation of epidemic outbreak.

4.3.4.4 Source reduction measures: Should be taken on intensive basis as described in 4.2.1.

4.3.4.5 Community awareness and participation is the key to success in outbreak control. Effective communication is required at different levels indicating the actions to be taken as follows:

At Household level:

- ⇒ *Ae. aegypti*mosquito bites during day times only. Kill adult mosquitoes by making use of commercially available safe aerosols (Pyrethroid-based).
- ⇒ Spray bedrooms, including closets, bathrooms and kitchens (by removing/covering all food items properly) for a few seconds and close the room for 15-20 minutes. Timing of the spray should coincide with the peak biting times of the *Ae. aegypti* mosquito, e.g., early morning or late afternoon.
- ⇒ Use commercially available repellents during the day time.
- ⇒ Intensify efforts to reduce actual or potential larval habitats in and around houses.
- ⇒ Cover water containers in the house to prevent fresh egg laying.
- ⇒ Have infants sleep under bed nets during the day.
- ⇒ Wear protective clothing (full sleeves shirts & full pants during day time).
- ⇒ Use tight-fitting screens/wire mesh on doors and windows.
- ⇒ Clogged gutters and flat roofs that may have poor drainage need to be checked regularly.
- ⇒ Water in bird baths and plant pots or drip trays should be changed at least twice each week.
- ⇒ Pet's water bowls need to be emptied daily.
- ⇒ In ornamental water tanks/garden, larvivorous fish (e.g., Gambusia, Guppy) need to be introduced. These small fishes eat mosquito larvae.

At School level:

- ⇒ School children should be provided with health education on all aspects of dengue and chikungunya fever: symptoms, mode of spread, the role of mosquitoes, where & how they breed/rest and how they can be controlled.
- ⇒ School children should be trained on how to detect and eliminate the breeding of *Ae. aegypti*in and around the schools, in their homes and in the neighborhood.
- ⇒ School children should be advised to wear protective clothing - full sleeves shirts & full pants during day time (during school time as well as before and after school)
- ⇒ In ornamental water tanks/garden, larvivorous fish (e.g., Gambusia, Guppy) need to be introduced. These small fishes eat mosquito larvae.
- ⇒ Weeds and tall grasses should be cut short; adult mosquitoes look for these shady places to rest during the hot daylight hours.
- ⇒ In case, water containers cannot be emptied, Temephos (1 ppm) should be applied on weekly basis.

At Community level:

- ⇒ People should form groups to supplement and reinforce efforts at the household levels.
- ⇒ Such group can identify commercial activities such as traders dealing in used tyres, which may be contributing larval habitats for the vector.
- ⇒ They can create awareness about dengue/chikungynya and seek cooperation for the removal of breeding places. Community activities against larvae and adult mosquitoes can include:
    - Cleaning and covering water storage containers
    - Keeping the surroundings clean and improving basic sanitation measures
    - Burning mosquito coils to kill or repel the mosquitoes
    - Burning neem leaves, coconut shells and husks to repel mosquitoes and also to eliminate outdoor breeding sites
    - Screening houses, particularly bedrooms

- Making available hand aerosols for killing mosquitoes
- Cleaning weeds and tall grass to reduce the available outdoor resting places for adult mosquitoes near houses

⇒ Using mosquito nets to protect infants and small children from bites during the day time and also insecticide treated nets and curtains to kill mosquitoes attempting to bite through the nets or resting on nets and curtains.

4.3.4.6 A suggested format for collecting the other required information in the field is as below:

Table 12

Location of Village	
Distance between affected village and sub-centre	
Receipt of information on first case	
How did the MPW inform the Medical Officer about the cases (Telephone / Messenger etc ?)	
When and how did the report reach DVBDCO or the District Surveillance Officer(DSO)?	
Who informed the Taluk Officer? How was DVBDCO informed?	
What control measures were taken?	
When did DVBDCO / DSO visit the affected village	
When were the samples collected and by whom?	
When was the result received?	
How was state program officer (NVBDCP) informed about the test positive report of sentinel center regarding Dengue / Chikungunya positive cases? (Telephone / fax etc)	
Details of action in chronology	
Who and how many were given health education?	
What were the health education messages?	
How many patients were treated?	

What exactly was done to intensify control measures against Dengue / Chikungunya?	
How was the Grama Panchayat informed?	
Who informed the Grama Panchyat?	
What assistance was provided by Gram Panchayat President (details)?	
Who detected breeding first? How many households were surveyed?	
How many days were needed to complete the survey	
What were the findings of fever survey?	
Who carried out source reduction and when?	
When were the Health Staffs of PHCs Trained for Entomological surveillance?	
For how many days source reduction was carried out in the village?	
How many water containers were emptied, cleaned or dried?	
When were blood samples sent to SSL?	
Was SSU IDSP informed?	
When and how SSU was informed?	
What is present situation?	

Chapter 5
Capacity building

5.1 Training in Clinical and Laboratory-based Surveillance, Diagnosis, and Case Management

One of the primary problems in management of dengue is misinterpretation and resultant confusion because of the term "haemorrhagic fever" implying a significant haemorrhagic component to the patho-physiology and overshadowing the increased permeability, which causes depletion of the intravascular component. A reorientation of the management towards assessment of the haemodynamic state and prompt but judicious fluid replacement is necessary. Unlike acute gastroenteritis, where fluid is lost from the body and intravenous fluid replacement can be assessed by matching input with output, in DHF / DSS, fluid is merely lost from the intravascular space, thus making an over hydration a concern in the face of hypovolemic shock. After this period of increased capillary permeability, movement of fluid reverses, enabling resolution of pleural effusion and ascites. Most, if not all, deaths due to dengue are potentially avoidable. Yet if every doctor were to experience a learning curve in acquiring the clinical acumen and insight in managing dengue, especially DHF/DSS, there may be unnecessary morbidity and mortality. Thus, it is essential to enhance this learning process by reorganizing the delivery of care to dengue patients.

A dengue training programme to reach to a wider audience has to be effective in imparting the bigger picture as well as nuances in dengue management. The doctor managing a dengue patient has to make evaluations of the haemodynamic state at several points of time. A broad-angled evaluation involves integration of clinical and laboratory parameters, which are in turn summation of the disease process as well as the ongoing treatment. This understanding is crucial in guiding decisions about the volume, rate and type of fluid infusion. A training programme should be adopted at different level of health facilities such as peripheral health centres, emergency departments and referral centres. To be successful, the programme should include not only lectures but several case studies/hands on training to illustrate the best practices and pitfalls in the management of dengue.Training should be given to physicians and nurses on the clinical aspects of dengue and on the appropriate management of patients.Training should also be imparted to dengue treatment clinics and hospitals in private sector.

5.2 Vector Surveillance:-

Assistant entomologists at the district level, Biologists at corporation / municipality, insect collectors and health workers need to be trained as follows:

- Statistical sampling methods for larval mosquito populations should be taught and used to optimize resource utilization. Innovative sampling methods for containers (e.g., essential, nonessential, natural) should be taught.
- Techniques and dosage of insecticide application should be discussed.
- Larviciding (focal) and residual (perifocal) treatment procedures should be taught and practiced.
- Space spraying techniques should be presented and evaluated.
- Safe handling of pesticides and recognition of pesticide intoxication should be emphasized.
- Procedures for determining vector susceptibility to insecticides should be taught
- Training courses on the proper use and operation of space spray equipment should be conducted.
- Simulation exercises should be presented.
- Study of vector bionomics and transmission dynamics of dengue and chikungunya, identifying local risk factors to develop a strategic action plan for its prevention and control.
- Mapping of different vectors (Aedes) for understanding the vectors involved in transmission and adaptations towards different environment in respect of Dengue and Chikungunya.

Health Library and Information Centre
CPHE - SOCHARA
Koramangala
Bangalore
TM-120
15601 P13

5.3 Environmental management:-

Panchayat members, field workers in urban areas, ward committee members etc need to be oriented as follows:

- Techniques in nonchemical source reduction of containers (e.g., draining, filling, puncturing, burial, and burning) should be demonstrated.
- Inspection techniques for foci amenable to source reduction (e.g., containers, tiers, flower vases, rain gutters, tanks, junk cars) should be demonstrated.
- Design, use, and repair of individual and community potable water supply systems(e.g., individual and communal standpipes, cisterns, and drums) using appropriate technologies to ensure water availability and quality, consistency of delivery, storage, and water supply protection and treatment should be covered.
- Local practice of recycling should be discussed and reviewed. Markets for recyclable discarded containers should be developed and evaluated.
- Integrated solid waste management, including proper solid waste storage; waste collection frequency and community coverage; clean-up campaigns vs. regular solid waste pickups; and special waste collection(e.g., tires, junk cars, auto batteries) should be presented.
- Environmental management at important non-residential sites, such as seaports, airports, used tire facilities, schools, and hospitals, should be stressed.
- House design and personal protection measures to reduce mosquito biting should be reviewed.

Chapter 6

6.1 The details of the Sentinel Surveillance Laboratories:

Sl No	Sentinel Surveillance Laboratory
1	Public Health Institute, Sheshadri Road, KR Circle, Bangalore –09 Tel: 080 –22213824, 080- 22370895 Fax: 080-22210248
2	District Surveillance Laboratory, Vaccine Depot Compound, Tilakwadi, DH&FWO, Belgaum–6, Tel: 08312-2424284, Fax: 08312-2424284
3	District Surveillance Laboratory, Railway Station Road, Mangalore-01, Dakshina Kannada, Tel: 0824- 2427316, Fax: 0824 – 2427316
4	Viral Diagnostic Laboratory, Opposite Scout Bhavan, BH Road, Shimoga- 577201. Tel: 08182- 222050, 08182-275356. Fax (DSU): 08182-275355
5	District Surveillance Officer, District Surveillance Laboratory, SNR Hospital Complex, Kolar-563101. Tel: 08152-224102, Fax: 08152-224102
6	Department of Microbiology, Vijayanagara Institute of Medical Sciences, Bellary -583101 Tel: 08392-235289, Fax : 08392-235202
7	Department of Microbiology, Karnataka Institute of Medical Sciences, Hubli
8	District Surveillance Laboratory, Mcgann Hospital compound, Shimoga
9	District Surveillance Laboratory, Behind District Hospital Compound, Chitradurga -577524. Ph: 08194-235657
10	District Surveillance Laboratory, District Hospital Campus, Athani Road, Bijapur.
11	District Surveillance Laboratory, Bidar. Ph: 08482-224144.
12	District Surveillance Laboratory, Behind District Health Office, Gulbarga -585102
13	District Surveillance Laboratory, District Hospital Campus, Bagalkot. Ph: 08354-236251.
14	District Surveillance Laboratory, District Hospital Premises, Raichur -584101. Ph: 08532-235300.
15	Dept of Microbiology, Indira Gandhi Institute of Child Health(IGICH), NIMHANS compound, Hosur Road, Bangalore
16	District Surveillance Laboratory, NPC Hospital campus, Nazarbad, Mysore -10. Ph: 0821-2438147.
17	District Surveillance Laboratory, District Hospital Campus, Tumkur. Ph: 0816-2260594.
18	National Centre for Disease Control (NCDC) lab, NTI campus, Bellary road, Bangalore
19	Manipal centre for virus research, Manipal University, Udupi district. Ph: 0820 - 2922718
20	District Surveillance Laboratory, CG Hospital campus. Davangere-4. 08192-255478.
21	NIV field station, Microbiology department, Victoria – Vanivilas hospital, Bangalore
22	District Surveillance Laboratory, District Health & FW Office, Hassan -573201. Ph: 08172-233699.

6.2

FORMAT FOR Daily /Weekly REPORT OF DENGUE

Date of report :

Sl No.	During the day /week								Up- to- date (Cumulative since January)								
	No. of Suspected cases	No. of Blood samples collected	No. of Tests done			No. positive (confirmed cases)			Deaths	No. of Suspected cases	No. of Blood samples collected	No. of Tests done			No. of Blood samples positive (confirmed cases)				Deaths
			IgM ELISA	NS 1	Other RDT	IgM ELISA	NS 1	Other RDT				IgM ELISA	NS 1	Other RDT	IgM ELISA	NS 1	Other RDT	Total	
Total																			

6.3

FOLLOW UP REPORTS OF DENGUE CASES

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District	Taluk :	PHC :	Period of report : From : To :

Sl.no	Name of the Dengue case	Complete address	Jurisdictional PHC/ Town	Population of the affected area	Source of case reported	Date of receipt of report of the case	Immediate follow up measures														
							Villages/Towns visited	Date of visit	No. of fever cases prevailing at the time of visit	No. of blood samples collected	No. of houses checked for Aedes breeding	No. of houses +ve for Aedes breeding	No. of containers checked	No. of containers +ve for Aedes breeding	House index	Container Index	Breau Index	No. eliminated through source reduction	No. eliminated through Larvicidal application	Other measures implimented	IEC activities taken up

Details of Aedes Larval Surveillance and Source Reduction

TALUK	PHC	Name of villages Surveyed	Date	No of houses		Indoor Breeding Sites												Out Door Breeding Sites																			
						Cement tanks		Plastic Barrels		Drums		Earthen Pots		Others				Solid waste										Others											
														Tin Containers		Stone Tanks		Glass, materials		Plastic materials		Grinding Stone		Cocounut Shell		Tyres		Stone Tanks		Cement Tanks		Plastic Barrels		Drums		Earthen Pots		Flower Pots		Tap pits	
				S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+	S	+
	Dist Total																																				

Chapter 7

Resources:

1) Dengue: Guidelines for diagnosis, treatment, prevention and control: New Edition; WHO 2009
2) Guidelines for treatment of Dengue fever /Dengue haemorrhagic fever in small hospitals; WHO SEARO; 1999
3) Guidelines on clinical management of chikungunya fever; WHO SEARO; October 2008
4) Essentials of Infectious Disease Epidemiology; Manya Magnus; Jones & Bartlet Publishers; VIVA Books. publicity@vivagroupinfo.com
5) Long term action plan; Prevention and control for dengue and chikungunya in the country; Publication by Dte of NVBDCP 2007; http://www.nvbdcp.gov.in/
6) Comprehensive guidelines for prevention and control of Dengue and DHF; Revised and expanded edition; WHO SEARO 2011.

Note :

Note

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Fax : 080-25539249